

FEBRUARY 7, 1966

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NOTES 2/7/66 BALCH

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S-II-T Stage - Proof pressure tests of side wall insulation were completed on 2/1/66 with no failures. Final preparations are continuing for LN tanking tests, with major constraints being completion of GSE testing and resolution of problems with both stage and GSE single point ground to permit power on stage. Except for final brackets still required on stage systems otherwise complete, the only stage system remaining with identified open work items against it is the Instrumentation System. ✓

Technical Systems - An RFQ package for installation of S-II Test Stand A-1 cable trays was reviewed and went out for bids on 2/3/66. An RFQ for the balance of S-II Test Stand A-1 technical systems installation is being evaluated. Phase I changes to S-II Test Stand A-2 that affect S-II Test Stand A-1 installation are being incorporated into Phase II specifications and drawings. Basic installation of One-Third Octave Analyzer System was completed on 2/1/66. ✓

A New Bombing Range in the MTF buffer zone has been proposed by the Navy. This range would probably affect planning for both the Picayune and Hancock County airports as well as the "regional" airport which has been considered. Whether the proposed Navy bombing range would be compatible with MTF operations is being investigated. ✓

Representatives of Negro Colleges of Mississippi and Louisiana visited MTF on 1/29/66. They were greeted by the NASA Site Manager and the principal managers of GE, S&ID and Boeing. Briefings and a tour of the site were followed by lunch in the MTF Executive Dining Room. It was generally concluded that the visit was very beneficial to both MTF and the institutions represented by the visitors. ✓

Institutional Publicity for MTF - Arrangements have been made to furnish the Southern Bell Telephone Company, Jackson, Mississippi, an MTF photograph for use on the cover of the Mississippi Gulf Coast Telephone Directory for 1966. The photograph will show the tugboat "Clermont" pushing a cryogenic barge, with the S-II Test Stand A-2 in the background. ✓

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H-1 ENGINE During the second test of a Thor engine at Rocketdyne/Neosho, an explosion and fire occurred at approximately X + 15 seconds. Considerable damage was sustained by the test facility, a two position test stand with one position shared by Thor and H-1 and the other position used by the Atlas sustainer engine. The damage will require \$60,000 and three to four weeks to repair. The other Neosho stand (No. 1) will have to operate on a two shift basis during the month of February. From early indications, the explosion originated in the LOX start tank and was sustained by fuel leaks.

Results obtained from engine testing of a modified LOX pump seal are very encouraging. Three seals have been modified by venting the seal spring cavity to the volute area and by increasing the radius of all shape edges of the seal. To date three seals have been tested fifteen times, each in three different engines, and no leaks have occurred. This is a major improvement since almost all production engines/seals have experienced minor leakage at start. Additional testing is continuing on an expedited basis.

RL10 ENGINE Guidance from LeRC indicates decreased emphasis on Centaur payload margin. We are evaluating the possibility of extending the vehicle and production support portions of the R&D contract to cover additional flight vehicles, in lieu of continued weight and impulse improvements.

J-2 ENGINE A complete J-2 engine was vibrated on the Rocketdyne 30K shaker during December. The engine was vibrated at levels and frequencies exceeding any flight or static vibrations forecasted by MSFC. The engine was successfully hot fired for 500 seconds this week. This test successfully completes the program to demonstrate the integrity of the engine to withstand boost phase vibrations.

Negotiations for the conversion of the Development portion of the combined J-2 Engine Contract (NAS8-19) were essentially completed (handshake) on January 31. Settlement was within Dr. Mueller's guidelines.

A scheduled full duration S-II Battleship test was terminated after 14 seconds by an erroneous CG Over Temperature cutoff. The problem was traced to an intermittent circuit caused by a loose thermocouple connector and moisture in a facility jumper cable connector. The problem has been corrected and the next test is planned for February 5, 1966.

A meeting was held at AEDC on Friday, February 4, among representatives from Air Force Systems Command, AEDC, MSF and MSFC to discuss the impact to the J-2 program at AEDC should the Air Force decide to move the LR-91 engine (Titan II and IIIC second stage) into the J-4 test cell. As a result of this meeting a jointly prepared TWX was sent to all organizations involved stating the positions of the Air Force and NASA. If the LR-91 is tested in the J-4 cell, a minimum 60 day delay to the J-2 program will result. I have discussed this with General Phillips and he understands our position and will be active in the resolution of this problem with AFSC. I will keep you informed regarding the status of this situation.

F-1 ENGINE During acceptance testing, engine F-5030 experienced a cracked injector baffle. Injector is being replaced and this engine will repeat hot-firing. Investigation leads to the conclusion that the baffle material was contaminated with oxygen during forging operations. Engine acceptance is estimated at four behind schedule.

During green run testing of a turbine using a slave turbopump, a turbine hanger apparently failed causing destruction of the turbine inlet manifold torus slated for engine F-5033. Minor damage was incurred by the test stand and the pump. Schedule impact is being assessed but is not considered major. The three-piece turbine manifold shroud was intact. A similar failure occurred several months ago on R&D engine 014 with that failure attributed to the forming process of the Hasteloy C hanger. Analysis and investigation are underway.

After two days on strike, employees at RETS returned to work pending completion of negotiations with the Federal Mediation Office.

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1. S-II: Mr. Hellebrand, the P&VE representative on Colonel Yarchin's technical survey team, reports that S&ID is actively engaged in defining a PFCT program for qualification of remaining components on the S-II-T and flight stages. An R&DO team is at Downey to support this effort and also to gain visibility into the latest qualification status of the "T-bird." We impressed on S&ID the fact that Boeing had 95 per cent qualified components on S-IC-T prior to the last static firing. ✓

The repair work on the insulation for the S-IC-T has improved to a point where we feel it will support the firing program; however, additional repairs between firings will be necessary. ✓

We have, with Mr. Balch (MTF), worked out a reasonably realistic S-II-T firing schedule as a possible base line for an incentive static firing contract. The ground rule is to provide enough time for two full duration firings with sufficient time for lead-up firings, repairs and exchange of components, to make it a meaningful stage development operation. ✓

2. ADDITION TO BUILDING 4610: The Structures Division of this Laboratory will be moved from the Huntsville Industrial Center (HIC) to the new addition on the weekend of 2-19/20-66. This organization has been at the HIC close to 6 years. With this move, this Laboratory will begin a series of moves which will bring all elements together for the first time since MSFC was organized. ✓

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1. ICD Management - The latest ICD matrix for SA 501 shows a cross-reference of affected contractors for each ICD. This chart is almost complete for the launch vehicle. More work has to be done for GSE, especially in the electrical area, but there is ample data for IO to begin validating contractual coverage. I-V-E and R-S will be the focal points to complete actions on all Saturn V ICD's. ✓
2. Configuration Management - Briefing to you has been rescheduled from 24 to 28 February. A suggestion by Dr. Rees to simplify and expedite Configuration Management procedures will be investigated immediately. It is possible that recommendations for improvements will be presented at the meeting. ✓
3. Data Management - A plan is being developed by MSFC Data Management to eliminate excessive documentation being generated on the GE, ESE Contract. An interim status report is given in the attached Memo for Record. ✓
4. Boilerplate Command Modules (BP's) - Answering MSFC's inquiry as to the availability of two boilerplates previously used by MSC as ground test vehicles, MSC (Mr. Bland) advised that BP 22 has been assigned to the MSC facility for earth landing and associated integrated testing and BP 12A to the White Sands Test Facility. This office will keep close contact with MSC in regard to the availability of future command modules. ✓
5. GT - 7/6 Rendezvous - A 10-minutes silent color film shown at the 12-30-65 Press Conference is available for interested MSFC personnel at R-S. The film is quite interesting and shows also the tumbling Titan second stage booster. ✓
6. Ramjet Information for General Dornberger - Thirty-five Ramjet Historical documents have been obtained in "Unclassified" form and conditions determined under which this information can be transmitted to General Dornberger. A request, coordinated with the Army Missile Command, for public release of these documents will be formalized upon receipt of pertinent information from Bell Aerospace Corporation. ✓

NOTES 2/7/66 FELLOWS

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1. MSFC General Support of the Apollo Program: The R-DIR review of R&DO's functions and manpower utilization, mentioned in NOTES 1/10/66 (attached) is being undertaken in a manner to be fully in accord with the guidelines and objectives established for this Program and associated accounting procedure. We are in the process of identifying resources available for this Program, including dollars, manpower, and materials and supplies on hand. ✓
2. R&D Initiations: During the past week, the laboratories have processed an additional \$10 million in procurement requests, bringing our total to \$127 million and getting us right on schedule with our initiation plan. ✓
3. Performance Evaluation Board Findings for Single Support Contractors: The three remaining single support contractors have indicated their acceptance of the Performance Evaluation Board's findings in the semi-annual evaluation and the Award Fee Findings and Determinations are being processed. ✓
4. Computation Single Support Contract: The Pre-proposal Conference for bidders for the support service contract for the Computation Laboratory is scheduled for February 9, 1966. Several companies are expected to participate. ✓
5. CCSD Proposal MD-107A: The preliminary review has been completed of the Saturn IB Vehicle System Integration Mission Support Proposal, MD-107A, prepared by CCSD for contract NAS8-4016. The review was conducted between R&DO and the IO personnel, and also included the contractor's management and technical personnel, so that the proposal could be reviewed in light of the MSFC/CCSD working relationship. Chrysler is now revising the proposal as an incentive contract; that proposal is to be received for MSFC review by the latter part of March. CPIF negotiations are planned for early April 1966. ✓

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1. Guidance and Space Flight Theory Contracts: The 24th technical meeting between Marshall Space Flight Center and our contractors conducting Guidance and Space Flight Theory Studies will be held February 16 and 17, 1966 in Morris Auditorium. Dr. J. P. LaSalle, an authority on Stability Theory from Brown University, the first speaker (1 p.m. the 16th), will present "Modern Version of Liapunov's Stability Theory". You are cordially invited to attend the meeting. ✓
2. S-IVB Workshop Experiments: We have proposed two low-cost experiments for the S-IVB Workshop to Mr. Duncan in R-RP. They are the orbital densitometer (developed under our technical supervision by contract with Celestial Research Corporation) and a two-sphere experiment for studying gas molecule surface interactions. Currently we are obtaining a prototype densitometer and the two-sphere experiment can be manufactured at no cost to MSFC. We are contacting Dr. Johnson concerning these two experiments, and will discuss other possibilities. ✓
3. Maximum Heating Trajectory and S-II Insulation: Recently, the decision was made to extend the use of 1.6 inch foam insulation on the S-II stage through 504. A lighter dual-seal type insulation is still under consideration for S-II of 505 and subsequent vehicles. Both insulation schemes have been reported to be satisfactory for meeting the current maximum heating trajectory design criteria. From a performance viewpoint, we would desire the dual-seal type insulation, since it is considerably lighter. To establish consistent design criteria from one stage to another, a new maximum heating trajectory will be developed. In developing this new maximum heating trajectory, we shall incorporate the new propulsion characteristics for the S-IC stage recently provided us by P&VE. (The thrust builds up from $\approx .5\%$ (above presently used values) at $t=40$ seconds, to 3.8% at inboard engine shut-down.) In developing this new maximum heating trajectory, we shall also consider such missions as synchronous orbits and polar orbits which could have higher heating profiles. ✓
4. X-15/Scramjet Experiment: On February 2, 3 and 4, OART saw the final oral presentation of Phase I of their "Hypersonic Ramjet Experiment Project". During this phase, the three contractors (GE, Marquardt/GASL, Garrett Corp.) have conducted preliminary design of an experimental SCRAMJET engine to be flown on the improved X-15A-2 research airplane. Each of them took a day to describe their engine and the proposed engine/airplane integration and development plan. Both GE and Garrett favor axisymmetric inlets with translating spike for contraction ratio control, sequential burning for subsonic/supersonic conversion, and droop-cowl geometry for smooth inlet closure during pre-ignition flight. Marquardt feels that the Ferri design, with square cross-section, swept leading edges and fixed geometry, is to be preferred. At this stage of the game, the atmosphere is highly competitive, since there is a feeling, perhaps not unfounded, that whoever of the three gets a Phase II contract (June/July 1966, around \$2M), will move into an area with a great future. Mr. von Puttkamer attended the SCRAMJET presentations. A more detailed resume of this NASA-project, together with an up-to-date assessment of Air Force's SCRAMJET flight test program, will be included in the SCRAMJET STATUS QUO briefing which we are preparing for you. ✓

2/7 JIS

1. S-IVB 204 STAGE FIRST ARTICLE CONFIGURATION INSPECTION (FACI): The S-IVB 204 stage FACI began at Huntington Beach January 24, 1966. At the end of the first week, approximately 200 drawings and related paperwork had been reviewed by the FACI team with discrepancies running about 9%. The length of time required to accomplish Phase I (prior to static firing) of the FACI presently appears to be four to five weeks. Phase II (after static firing) will begin about the second week of April 1966. ✓
2. RCA 110A COMMITTEE: The committee has completed Phase I of the test program with the establishment of a solder repair procedure. Test data proved that temperature cycling does not harm repaired solder joints, (repaired in accordance with the established procedures). Examinations continue on all aspects of the parity problem, in an effort to preclude recurrence of the problem. ✓
3. ESE SPECIFICATIONS: With regard to your discussion with Dr. Lanzkron about ESE field quality problems, the problem of application of "flight" specifications to the GSE was recognized early in the GE/ESE program by both this Laboratory and Astrionics Laboratory; however, it was felt that, by proper interpretation and making the "acceptance point" at MSFC, this problem would not become unreasonable. Schedule slippage had the effect of placing decision making at numerous field sites by lower level government agency inspection personnel which compounded the specification problem. We have constantly had a considerable number of engineering types trying to resolve specification nonconformance problems in the field. We feel that we are over "the hump" with GE subcontractors. The need for new GSE specifications which are consistent with the end items use still exists; however, we have been working toward this goal together with Astrionics and will redouble our efforts. ✓
4. QUALIFICATION AND RELIABILITY TESTING: A study was made to compare the qualification and reliability testing on components of S-IC, S-II, and S-IVB stages of the Saturn V. The test requirements of each stage were reviewed and recorded in accordance with a standard definition. The comparison was based on the number of components to be tested, the number of samples, the number of tests for each sample, and the levels and duration of testing performed. Significant observations from the study were: (1) The Boeing Company tests the largest number of different components, Douglas Aircraft Company tests the next largest number and North American tests the least number of components. (2) The number of samples required for test by Douglas Aircraft on the S-IVB stage is considerably less than required by Boeing and North American Aviation on the S-IC and S-II stages. (3) The number of tests required for the S-IVB stage components is significantly less than that required on the other stages. (4) Of the components tested, North American performs more extensive qualification and reliability testing as indicated by the total number of tests, and the severity of tests. This is especially true in the environmental and overstress test categories. We will take this up with the different primes - to align their programs or obtain logic for the differences. ✓

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1. RCA-110A MEMORY PARITY PROBLEM: (*Reference Item 1 Notes of 1/31 reprinted below). On 2/3/66, a working group representing the Astrionics Laboratory, Quality and Reliability Assurance Laboratory, and RCA met and agreed upon a solder connection rework procedure which will result in a reliable solder joint and which can be performed in a minimal amount of time. There are an estimated 75,000 connections which must be reworked in each 110A computer system. The boards from three computer systems at RCA, Van Nuys, and all spares will be reworked first. These reworked boards will be used for any emergency replacement at Complex 34 prior to AS-201 launch. The boards will be cycled through the total complement of RCA-110A computer systems. ✓

2. ESE SPECIFICATIONS: We are working with QUAL to set up a small team (4 to 5 people) who will review the Electrical Support Equipment Specifications to make them more realistic. ✓ We found that in our program the specifications in many cases did not give appropriate tolerances and were being over-interpreted by zealous inspectors at the many subcontractors on the ESE program. ✓ We have an excellent record of the requests for specification changes and requests for deviation to the specifications which were accumulated on this program. By review of these and visits to General Electric and its subcontractors we can achieve our goal of having "Realistic Specs." ✓

*From 1/31/66 Notes

1. RCA-110A PARITY ERRORS: Investigation by RCA of the causes of 110A computer systems parity errors at VLF 34 has revealed that the probable remaining cause of errors is fractured solder joints on module boards. All other equipment causes have been removed by RCA at VLF 34. A proposed plan for VLF 34 rework of fractured solder joints will be transmitted to MSFC on 2/1. Tentative plans for an immediate interim fix involving the exchange of printed circuit logic boards between the Astrionics Laboratory computer and the AGCS computer at VLF 34 were set aside after discussions with Dr. Gruene. Although this exchange of boards looked attractive from the standpoint of alleviation of the parity error problem, it was decided that other risk factors outweighed the possible advantages. In accordance with MSFC's previous request, RCA will maintain 24-hour around-the-clock technical representative coverage at VLF 34 through the AS-201 launch, in addition to maintaining at KSC a design engineer to monitor, assist, and provide design engineering coverage for VLF 34 operations. ✓

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S-IC

S-IC-I stage and facility checkouts and preparations for the propellant load test continued. The propellant load test is scheduled for February 8, 1966. ✓

S-IVB BATTLESHIP (MSFC)

Test S-IVB-015 was conducted on February 4, 1966, at the S-IVB Test Stand for a duration of 445.0 seconds. All test objectives were met successfully. ✓

S-II BATTLESHIP

An attempt was made to conduct a full duration (390 seconds) static firing at the S-II Battleship Facility on Thursday, February 3, 1966. The attempt resulted in a cutoff at T + 14 seconds from a Gas Generator Over Temperature (GGOT) automatic cutoff system on Engine No. 1. The S&ID explanation was thermocouple malfunction due to moisture in the instrumentation cable connector which caused the GGOT device to sense erroneously an over-temperature condition. The following paragraphs are a brief preliminary test summary.

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- a. The LO_2 and LH_2 loading was accomplished through the facility transfer system since the stage fill and drain valves have been removed for modification.
 - b. The preconditioning of the LH_2 engine system was accomplished by utilizing the over board bleed system with the LH_2 stage tank pressurized to 42 p.s.i.a. No attempt was made to operate the LH_2 stage recirculation pumps.
 - c. The stage system was used to pressurize the LH_2 tank for pre-pressurization and static test. The LO_2 facility system was used for pre-pressurization due to a cracked bellows in the stage system.
 - d. The propellant utilization computer was activated at T + 5 seconds, however, the computer drove the P.U. valves toward 4.5 mixture ratio instead of a 5.5 as was intended. This was due to the capacitance probe sensing more LH_2 than LO_2 . The condition resulted from monitoring the LO_2 and LH_2 loading from point sensors and not the capacitance probe read outs.
 - e. All engine parameters appeared normal. ✓
 - f. The full duration test had been rescheduled for Saturday, February 5, 1966, but was cancelled when the No. 2 engine P.U. computer problem was not resolved. Another firing attempt will be made Tuesday, February 8, pending resolution of the problem.

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INTER-CENTER COMMITTEE ON ADP: The NASA Inter-Center Committee on ADP held its semi-annual meeting at Langley on January 26, 27, and 28. This committee, composed of one member from each of the NASA Centers, has as its mission to share resources and to advise NASA top management in the computer field. This particular meeting reviewed and revised the recent NASA handbook (NHB 2410.1) on ADP. This handbook establishes reporting procedures on computer matters and its issuance was directed by Dr. Seamans. It is hoped that these revisions will streamline procedures insofar as the centers are concerned. A presentation of our plans for third generation computers was also given at this meeting. ✓

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AS-201: The CDDT was scrubbed at minus 200 minutes because of facility liquid hydrogen leaks. This occurred after numerous holds because of leaks in valves and fittings on both the spacecraft and the vehicle. These were of the type experienced in Saturn I. The impact is not yet known. ✓

VLF 37-B: You will recall that in an attempt to recover schedule, G. E. was given the job of receiving the DDAS and countclock at the vendors and installing the equipment and checking it out at KSC. DDAS sell off was scheduled for 28 February. Two of the DDAS units were from Emerson Electric and were shipped by Allied Van Lines 2 February. They were apparently trans-shipped enroute and arrived at KSC upside-down in the van. Many panels came loose and were mechanically damaged. The impact is not yet known, however a work-around should be available with the other 8 units. ✓

EMERGENCY DETECTION SYSTEM (EDS): (Ref: Dr. Haeussermann's Notes 1/31/66, copy attached.) We were not in full agreement with the position established in the 1/13/66 presentation to Dr. Rees relative to CCSD performing the Saturn V EDS component testing. Since this work is logically under the purview of a different prime contractor and was not contemplated in the CCSD procurement plan, experience has shown that an extremely difficult contractual problem would be encountered. I understand that CCSD has performed the Saturn IB qualification testing in government facilities here in Huntsville, which could presumably be used also by Boeing. Only the reliability testing will be done in CCSD facilities at Michoud. If the CCSD facilities at Michoud are critical, it may be possible that a "use arrangement" for Boeing could be developed. We will discuss this matter further with Saturn V and Astrionics. ✓

SA-203 IU TV AND TM ANTENNAE: (Ref. Dr. Haeussermann's Notes 1/31/66, copy attached.) The type of change mentioned by Dr. Haeussermann on the design of the IU-203 antennae continue to plague us in trying to meet an acceptable delivery date for IU-203. Most of the time it is not a question of the technical validity of the changes but rather a problem of untimely definition of the change. I believe we finally have IBM geared up to the proper sense of urgency on the IU's, but this contractor nor any other contractor cannot make schedules unless we develop and impose our technical requirements in a timely fashion. Dr. Haeussermann stated that the new antennae would be delivered in a time frame which would support the IU checkout date. He failed, however, to mention that it will be necessary to remove coldplates previously installed and make some changes to the IU structure which may very well delay the completion of assembly.

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Copy Attached: Dr. Haeussermann's Notes 1/31/66

1. RCA-110A PARITY ERRORS: Investigation by RCA of the causes of 110A computer systems parity errors at VLF 34 has revealed that the probable remaining cause of errors is fractured solder joints on module boards. All other equipment causes have been removed by RCA at VLF 34. A proposed plan for VLF 34 rework of fractured solder joints will be transmitted to MSFC on 2/1. Tentative plans for an immediate interim fix involving the exchange of printed circuit logic boards between the Astrionics Laboratory computer and the AGCS computer at VLF 34 were set aside after discussions with Dr. Gruene. Although this exchange of boards looked attractive from the standpoint of alleviation of the parity error problem, it was decided that other risk factors outweighed the possible advantages. In accordance with MSFC's previous request, RCA will maintain 24-hour around-the-clock technical representative coverage at VLF 34 through the AS-201 launch, in addition to maintaining at KSC a design engineer to monitor, assist, and provide design engineering coverage for VLF 34 operations. *Quilley*

2. SA-203 IU TV AND TM ANTENNAE: The original design of TV and TM antennae for SA-203 IU did not, according to test results performed on prototype, meet requirements for bandwidth. As a consequence, the original design had to be dropped. A prototype of a redesigned unit is being tested. Flight units of this new design will be delivered to IBM 2/14, still satisfactory for start of checkout. Full qualification will be completed 3/31. *Summer*

3. EMERGENCY DETECTION SYSTEM: Presentation of 1/13 to Dr. Rees concluded with the following agreements: (a) CCSD will perform Saturn V EDS component testing ?? (b) Sequence Controller will be ordered for testing under the EDS program. (c) Astrionics will request Saturn V Test Office for EDS Contact. (d) It was agreed that completion of Qualification Phase of EDS Testing Program was mandatory before the first manned flight. We have a very tight schedule for EDS testing. Procurement of items that are to be tested under the Saturn V EDS program have been initiated. *Fikes*

4. SPIN GYRO PROJECT: The cryogenic superconductive gyro review at GE, Schenectady, covered the Mark II model, which has been designed and partially manufactured for accuracy testing on a gyro precision test stand. Test results can be expected in about 6 months.

Fikes - is this new, additional testing over & above that currently under contract to CCSD?

Fig 1

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1. Welding of "T" Stiffeners for S-IC Lox and Fuel Containers: We have for some time studied (in-house) the feasibility of welding "T" stiffeners (extrusions) to skin segments versus milling the stiffeners out of a 2 1/2" thick plate. When a defect skin panel became available from Wichita we welded "T" stiffeners to this skin using automated skate welding techniques with high welding speeds (40 inch/minute). This skin panel has now been shipped to Wichita for forming into a cylindrical shape and evaluation by Boeing Engineering. This concept has the following major advantages:

- a. It would result in unloading Air Force owned skin mills in Wichita which have always been a critical area in our program.
- b. It would save more than 70% of raw material for skin panels.
- c. It would further result in substantial cost savings in the amount of \$168,000 per stage.

The results of these studies are very encouraging and The Boeing Company is now taking up the development for possible introduction into the main stream of production--at no additional cost, as I understood them. It could be introduced for stage 510 or 511. Mr. Urlaub is fully informed about this development. Total cost of additional tooling would be less than the cost savings for one stage. ✓

2. Support of the Apollo Program: A meeting took place this week to resolve the problem of obtaining resources (materials, support contractor, outside purchases) for various small research and development projects (AAP and others). The meeting was attended by Messrs. Huth, Hardeman, Napper, Foxworthy, Dr. Siebel and members of their staffs. This week, Mr. Hardeman will set up cost codes to allow materials to be obtained and funds to be used for contractor support. This will relieve the immediate problem. Other efforts in R&DO are underway to define the scope of the program and the necessary procedural changes. It seems that by these efforts we will be able to avail ourselves of our accumulated resources for the accomplishment of diverse tasks and that we will gain in flexibility and speed of response. ✓

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SA-501 Test and Checkout Requirements Document: The SA-501 test and checkout requirements document was reworked and released Feb. 2. ✓

AS-201 Overall Tests and Countdown Demonstration Tests at KSC: We have been attending the overall tests and the countdown demonstration tests at KSC this week and have worked out the problems encountered. There seems to be a growing ease in handling automation problems, but our first look indicated that the smallest problem was causing a large impact in the countdown process. The main thing we have done is work with the Cape to redistribute the automation activity over the countdown time in a more even manner and, thus, reduce the average traffic through the computer system while our programs are still new and until we are more confident in their ability to interleave. The results of this effort plus additional hardware precautions resulted in very good support of the countdown demonstration tests. The rest of the system seems to have a noise problem, which we are still working on with KSC and MSFC. ✓

We had the overall test records examined by the Post Flight Evaluation Working Group. This is another check on the fact that the vehicle is working properly. ✓

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1. S-IC Stage Activity at KSC:

- o Monday - 31 Jan 66 - S-IC weight simulator moved into Vertical Assembly Building (VAB). ✓
- o Friday - 4 Feb 66 - Test of VAB crane and handling equipment with weight simulator. ✓
- o Monday - 7 Feb 66 - Plan to move simulator out of VAB and move S-IC-F into low bay of VAB. ✓
- o Wednesday - 9 Feb 66 - Plan to ship simulator to Michoud (required for testing new stage transporters). ✓

2. S-II Battleship Stage Firing - The S-II Battleship was fired at 7:08 pm, CST, on Thursday, 3 February 66. Scheduled duration was 350+ seconds. Premature cut-off due to gas generator over temperature on #1 engine. First look evaluation indicates a bad cable harness or connector on engine #1 caused premature cut-off. Firing rescheduled for Tuesday, 8 February 66. ✓

3. S-IVB-501 Stage - Telemetry "Black Box" Delivery Problem - Considerable difficulty has been experienced by Douglas Aircraft Company, (DAC) in getting adequate delivery of acceptable telemetry "black boxes". Mr. Hoberg (ASTR) is at DAC to study the problem, determine with DAC the corrective actions required, and to expedite resolution. Preliminary reports indicate that necessary actions have been agreed upon and expedited corrective action is underway. ✓

4. S-IU-200/500S-2 Structural Test Unit - Major failure occurred on Wednesday, 2 February 66, when 140 percent of SA-506 max "Q" loads were applied over the ST-124 platform position. Planned tests not completed were:

- o Max "Q" loads applied over access door.
- o Max "Q" loads applied over batteries.

Cause and impact of failure being investigated. ✓

5. Saturn V Operational Display Systems - The first Saturn V Operational Display System accepted from Sanders Associates at Astrionics Laboratory on Wednesday, 2 February 66. ✓

NOTES 2/7/66 SPEER

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1. RANGE SAFETY FOR POLAR ORBITS: A meeting between Headquarters and Center personnel was held at KSC to discuss data needed for the AFETR study on launching Saturn launch vehicles into polar orbits out of Cape Kennedy. It was agreed that four trajectories with various degrees of doglegging would be selected. Impact and kill probabilities on a county-by-county basis in South Florida will be traded off against payload losses. This work is being performed by R-AERO. ✓

2. LAUNCH PHOTOGRAPHIC REQUIREMENTS: KSC is unable to meet the combined demands of all agencies for launch photographic coverage. OSRO has scheduled a meeting at KSC to establish new policy concerning retention of originals, number of copies required, and funding. It appears possible that MSFC may have to fund for some of our photo requirements. ✓

3. AS-201 LIEF ACTIVITIES: Launch preparations are continuing to be supported via LIEF. Approximately 65 personnel participated in the countdown demonstration test (CDDT) on 2/6. Three launch wind simulations were successfully performed with MSC participation; results were transmitted to KSC approximately 1 hour after receiving data. Items of interest during CDDT included duration of J-2 chilldown and adjustments on some redline values. HOSC performance was generally satisfactory. ✓

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1. PEGASUS: No changes this week. - As you requested, I drafted a letter to Dr. Mueller for your signature, requesting his guidance regarding a fourth Pegasus flight. Ed Gray believes that Dr. Mueller will not be in favor of a fourth flight. I do not feel that we should, under these circumstances, press for a fourth flight. ✓

→ No. 1 agree with your conclusion B

2. AAP: EARTH ORBIT - Dr. Forsythe, OSSA, and representatives from Ball Brothers gave a presentation of the Apollo Telescope Mount (ATM) Project at Astrionics last week. Dr. Forsythe responded very favorably to the suggestions which you made earlier last week (compatibility with LEM, etc.) It appears that we have a good chance of obtaining the assignment. Funds for '66 and '67 were budgeted by Dr. Seamans; they are not yet finally approved, but Dr. Forsythe is very optimistic that he can find sufficient funds for the project. Astrionics is preparing the PDP for your signature. ✓

✓ I hear MSC has the "inside track" on this one B

LUNAR SURFACE - Westinghouse is making encouraging progress on the Lunar Drill design. Two main problem areas have been associated with lunar rotary drilling. A solution for the first, adequate chip removal, has previously been demonstrated. Now a technical breakthrough seems to have been made which will lick the second problem, that of bit cooling. A system employing internal two-phase water cooling has been used successfully in tests to drill dry basalt for short distances without any bit deterioration or unusual heating. During tests the bit matrix temperature stabilizes at approximately 200°F (366°K) at slow drilling rates and 300°F (422°K) at higher penetration rates. ✓

3. ART/SRT AND SUPPORTING DEVELOPMENT FY-1966 PROGRAM STATUS:

	<u>ANNUAL PLAN</u>	<u>PROGRAM AUTHORITY</u>	<u>PROCESSED TO FMO</u>	<u>OBLIGATED</u>
OART	16,264,000	15,764,000	11,193,519	3,262,041
MSF (904)	8,650,000*	8,650,000*	8,764,009**	2,919,430
OSSA	5,903,000	608,000	478,024	199,122
OTDA	1,500,000	1,500,000	895,967	205,730
TOTALS	32,317,000	26,522,000	21,331,519	6,586,323 ✓

* Reflects \$800,000 reduction effected by Headquarters. ✓

** This includes \$1,140,000 processed without "Scope of Work" statements for the purpose of reserving program authority to protect our uncommitted Supporting Development funds. It also includes Purchase Requests amounting to \$150,000 which were processed against anticipated return of the \$800,000 withdrawn earlier by Headquarters. ✓

2/7/66

B2/12

1. AAP EXPERIMENTS PLANNING AND CONTROL SYSTEM: For several months Bill Huber and his people have been working with Headquarters (Pemble Field) to develop a computer program for an Experiments Planning and Control System. Thanks to the outstanding help and cooperation from Comp Lab, we will have the system checked out and working in time for material to be presented at the next MSFEB. Due to the fine response we have given Headquarters in the development of the program (and since they don't have a computer that can accommodate the program at this time), we have been asked to do all the runs for them. This will not constitute a major effort and can be easily accommodated between Comp Lab and ourselves. (Comp Lab concurs.) For the small effort it has and will require, the benefits are considered very worthwhile, i.e., (1) MSFC will have the latest status of all AAP Experiments (and first), (2) all juggling of experiments, that is gaming the experiments for various situations, will be done by us, (3) all reporting of status and various alternatives will be handled by this Center, and (4) it is hoped that what we have developed can be used "as is" as well as "added to" for our own internal management use for those "experiments" that are assigned to MSFC. This effort has been coordinated with and supported by Stan Reinartz and company and will be reviewed by Bill Johnson this week. We plan to review it with you at the next "Internal Review for the MSFEB" Meeting at MSFC. ✓

2. WORKSHOP AND EXPERIMENTS FOR 209: MSC has for the third or fourth time delayed our going to MAC to get data on their proposal and engineering data on their subsystems. (I think we are getting the "run around" which will be somewhat detrimental to our proposal to Mueller.) ✓

FEBRUARY 14, 1966

MSFC ROUTING SLIP					
	CODE	NAME	INIT:	<input type="checkbox"/> ACTION	<input type="checkbox"/> INFORMATION
1		<i>Dr. von Braun</i>			
2					
3		<i>File</i>			
4					

REMARKS

*Enclosure to 2/14/66 notes
Reissler*



CODE <i>Acio-DIR</i>	NAME <i>PA Linsen</i>	DATE
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MSFC - Form 183 (Rev. February 1961)

BRIEFING REGARDING HIGH REYNOLDS NUMBER FACILITY

December 16, 1965

Aero-thermodynamic predictions for launch vehicles require wind tunnel testing because many of the flow conditions encountered by the vehicle cannot be dealt with analytically. The validity, or better, the applicability of wind tunnel test results to the full scale situation is governed by the degree of adherence to a number of scaling relations, such as Mach number and Reynolds number. Rarely can one afford not to simulate Mach number but with Reynolds number nonsimulation is more often the rule than the exception; for instance, in the critical flight regime of maximum dynamic pressure, even the largest tunnels in the country come only to within 1/100 of the full scale condition for Saturn V, or about 1/50 for Saturn IB. It is commonplace, mostly among airplane designers, to more or less ignore such Reynolds number deficiencies provided transition to a fully developed turbulent boundary layer is assured. This is often helped along by applying "trips" to the tips of models. The contention that Reynolds number has little effect is based on the appearance of typical force (e.g., drag) plots versus Reynolds number which seem to go asymptotic after the critical or transition Reynolds number has been traversed. We consider it highly speculative, however, to be content with such simple reasoning; as a matter of fact, we know and have documented evidence from NASA reports that Reynolds number has indeed a significant effect in the post-transitional regime whenever flow separation is encountered, or where parameters of turbulence itself are the decisive design determinants. Consequently, our ability to predict the aerodynamic environments is poor where these effects predominate, as they do for load distribution at very high angles of attack (important for vehicle break-up prediction), fluctuating pressures in-flight, response to ground wind, compartment venting and base flow to name a few. Hopefully, we have specified conservative design criteria; however, this is a tricky business, not only from a view point of estimating the degree of ignorance, but sometimes a seemingly conservative value may really be unconservative

D-2
(D)

from other points of view. Realizing that a conventional wind tunnel to do full scale Reynolds number testing would be hopelessly expensive (400,000 horsepower for continuous operation), we had accepted this dilemma as an inevitability until we realized about a year ago that a short duration "tube tunnel" of relatively modest cost (about 3 million dollars) might be the answer to many of our problems. Our belief in the feasibility of such a facility was fortified by the successful application of the basic technique in conjunction with base heating tests at Cornell (even though these tests were restricted to much lower pressures than what we would need) and by an AGARD publication by Professor Ludwig from Goettingen on the successful performance of a pilot tube tunnel of modest size. The principle is astoundingly simple: A pressurized, large, long pipe (8 to 11 feet diameter by 300 feet long is our proposal) is closed off at one end and terminates in a conventional wind tunnel section at the other. Our latest concept provides for a resealable closure at the downstream end of the test section. The sudden opening of this closure starts the air flow through the test section, and this flow remains constant for the duration that it takes the rarefaction wave to travel to the end of the tube and, by reflection, back to the test section. This yields about 1/2 second useful running time for a 300-foot tube. This is "long" by comparison to shock tunnels which operate in the millisecond range; thus, there should be little trouble to get meaningful data from an instrumentation point of view. The chronology at the end of this briefing tells the story of what happened to our proposal. I would like to concentrate, therefore, on what we plan to do. We are continuing an intensive feasibility study, and up to now we have not uncovered anything which is outside the present state-of-the-art. Of course, we have no illusions about this project being a difficult one and not all questions will be answered at once, but I believe that the quantum jump in performance well justifies the effort and the relatively modest expense. As it will take about three years for such a facility to become productive, its greatest benefit is for the Saturn V improvement phase and future vehicles. While Dr. Eggers appeared to be quite willing to accept future vehicle benefits as valid justification,

our primary emphasis for "selling" the facility must be based on present programs - at least, this is Mr. Maus' opinion, and I share it. We are therefore putting together a technically detailed story on the impact of the various uncertainties in our present data on our vehicles and relate them, as well as we can, to such tangibles as money, payload, operational restraints and risk. A new presentation of our initial technical rebuttal argument with a slant toward program impact will be given in January to Dr. Eggers, et al., and it would be most beneficial if influential OMSF people would be present then. Preferably these people should be briefed by Dr. Mueller beforehand, to assist us in the position that the ultimate judgement on program-related necessity must rest with the developer and that OART's task should be mostly restricted to ascertain the scientific validity of the underlying technical argument.

CHRONOLOGY

- 1957 Professor Ludwig publishes AGARD report on pilot tube tunnel.
- 1964 Cornell (Herzberg) proposes large tube tunnel for SST, is
 turned down by OART (Ames and Langley).
- Jan. 65 Aero submits preliminary proposal for High Reynolds Number
 Facility.
- Mar. 65 MSFC management approves facility for inclusion in preliminary
 budget.
- June 65 Aero acquaints Headquarters people with project.
- July 65 Bill Fleming's memo to Lilly turns down facility.
- Sep. 65 MSFC sends letter to Mueller refuting Fleming's position.
- Oct. 65 Official deletion of facility by MSF from the 1967 program.
- Dec. 65 Eggers, Fleming and Crobaugh are given rebuttal presentation
 at Marshall leading to suggestion for follow-on presentation
 with more specific program-impact information.

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

Memorandum

TO : See attached list

DATE: December 16, 1965

FROM : Deputy Chief, Aerodynamics Division, R-AERO-A

SUBJECT: Meeting with Headquarters personnel concerning proposed High Reynolds Number Facility

The meeting was opened at 8:30 AM on December 3, 1965, by Mr. Kline who gave a brief description of the organization and staffing of MSFC. Attendees were:

Dr. Eggers, R	Mr. Read, R-RM-F
Mr. Fleming, PT	Mr. Dykes, F&D-CH
Mr. Crobaugh, PT	Mr. Lawson, F&D-S
Mr. Gorman, DEP-A	Dr. Geissler, R-AERO-DIR
Mr. Newby, DEP-A	Mr. Jean, R-AERO-DIR
Mr. Neubert, DEP-T	Mr. Dahm, R-AERO-A
Mr. Maus, E-DIR	Mr. Holderer, R-AERO-A
Mr. Kline, E-D	Mr. Felix, R-AERO-AF
Mr. Weidner, R-DIR	

Dr. Geissler then presented the mission and organization of Aero-Astrodynamic Laboratory in more detail. He also mentioned some problem areas which have been particularly difficult to get a "handle" on using existing analytical techniques and facilities, such as in-flight acoustics, and ground wind loads.

Mr. Dahm then addressed himself to the primary purpose of the meeting - that of further justifying the proposed facility to OART as well as to Mr. Fleming. The primary objections which Mr. Dahm sought to answer were those delineated in a memo from Mr. Fleming to Mr. Lilly (which was subsequently forwarded to MSFC). The gist of these objections were:

1. There is not a sufficiently demonstrated need for the proposed facility. (A similar facility was proposed by Cornell Aeronautical Laboratory to support SST development work and was turned down by OART).
2. Flight measurements should be made on the Saturn I or IB vehicles to provide desired data and maybe negate the need for the facility.
3. There are major engineering development problems in the construction of such a facility.

Mr. Dahm's presentation dealt with these comments in sequence. The essence of his remarks concerning objection number 1 was that OART's conclusions were based on airplane experience (vehicles with clean aerodynamic shapes and a minimum of separated flow). In contrast, our launch vehicle configurations are unclean in an aerodynamic sense and therefore much more susceptible to large

separated flow regions which are sensitive to changes in Reynolds number even above transition.

The suggestion that the data be provided by flight measurements was answered by stating that such measurements would represent an appreciable portion of the facility cost, are subject to considerable inaccuracy, require long lead times, and in some cases are not even possible (such as, pressure distributions at angles of attack up to 20°).

As to the engineering problems cited, the Aero-Astroynamics Laboratory is well aware of the specific problem areas and is actively studying these, both in-house and by a contract with Fluidyne Corporation. The one problem singled out in the memo will be considerably reduced in scope by changing the diaphragm location from upstream of the test section to downstream. This change also makes possible the use of smaller diaphragms.

In general, Mr. Dahm's presentation followed very closely the material contained in AIN 21-65, dated September 10, 1965, entitled "Discussion of a Proposed High Reynolds Number Test Facility." At this point in the meeting, the floor was opened for discussion. Dr. Eggers indicated that he felt that the aerodynamic difference between aircraft and launch vehicles is not as great as Mr. Dahm indicated. He also asked if MSFC personnel were making maximum use of OART skills and facilities in the solution of the problems outlined by Mr. Dahm and Dr. Geissler. Mr. Dahm indicated that we were working closely with both Langley and Ames on problems of unsteady aerodynamics, such as ground wind loads, in-flight acoustics, and panel flutter. Even so, the facilities and techniques do not provide all of the required answers. Dr. Eggers and Mr. Fleming asked several questions about the impact of the aerodynamic problem areas on payload weight, reliability, operational restrictions, cost, and schedules. Dr. Eggers stated that he felt that the answers to these questions had not been sufficiently emphasized in the presentation. His comment was that we had not "closed the loop." Dr. Eggers stated that he now has the feeling that some of our work has not received proper attention in OART, particularly by real top rate men. He further recommended that we make our pitch again in Washington to a group of "top aerodynamicists" in OART with the "loop closed" to properly emphasize the importance of our problems. He stated that, regardless of the outcome of the facility exercise, he intends to see to it that OART devotes proper attention to our problems.

Mr. Weidner asked what effect the proposed MSFC location has on the approval or rejection of the facility. Dr. Eggers answered in the negative. Mr. Fleming commented that any facility which would be used for pure research should, of course, be located at a research center. Mr. Newby then asked Mr. Fleming if wind tunnels, per se, are regarded as research tools, to which Mr. Fleming finally answered in the negative. In this connection, Mr. Fleming stated that under prevailing conditions NASA had to present a reasonably unified position to the Bureau of Budget to get this kind of a facility approved. That is why he considered it important

that not only MSFC people but also those from the OART centers have to be on board.

A brief follow-up meeting to decide on further action was held on December 6 among MSFC principals. Minutes of that meeting are contained in a memorandum for record by P. Read, dated December 7, 1965.


Oscar C. Holderer

Addressees:

DEP-A, Mr. Gorman
DEP-A, Mr. Newby
DEP-T, Mr. Neubert
E-DIR, Mr. Maus
E-D, Mr. Kline
R-DIR, Mr. Weidner
R-RM-F, Mr. Read
F&D-CH, Mr. Dykes
F&D-S, Mr. Lawson
R-AERO-DIR, Dr. Geissler
R-AERO-DIR, Mr. Jean
R-AERO-A, Mr. Dahm
R-AERO-A, Mr. Holderer
R-AERO-AF, Mr. Felix

8 DEC 1965
December 7, 1965

MEMORANDUM FOR RECORD

Subject: Minutes of meeting, December 6, 1965, Re: Further action on High Reynolds Number Facility

ATTENDEES:

Mr. Maus, E-DIR	Mr. Dahm, R-AERO-A
Mr. Newby, DEP-A	Mr. Holderer, R-AERO-A
Mr. Cook, R-DIR	Mr. McNair, R-AERO-P
Mr. Richard, R-TO	Mr. Bethay, E-T
Dr. Geissler, R-AERO-DIR ✓	Mr. Read, R-OM-PF
Mr. Jean, R-AERO-DIR	

PURPOSE OF MEETING: To establish plans for the preparation of a presentation to Dr. Eggers and scientific personnel in his organization as requested by Dr. Eggers during his December 3, 1965, visit. The presentation should add quantitative values (how big are impacts in terms of dollars, schedule, reliability, weight reduction, etc.) to the qualitative presentation made on December 3, 1965.

DISCUSSION: The following points were agreed upon:

1. The proposed facility would have no impact on Saturn IB thru SA 212 or the earlier Saturn V flights. However, depending on how well the present schedule is maintained, Saturn V flights occurring from early CY 1969 on, could be impacted and some kind of quantitative values could be assigned to these impacts. This is also true of possible follow on Saturn IB program.
2. The value of the facility can definitely be shown with regard to Saturn V improvement and AAP programs, and it was agreed that a strong point be made of this.
3. It is mandatory that Dr. Mueller be convinced of the necessity for the facility, and a prerequisite to convincing Dr. Mueller is to get Dr. von Braun's strongest backing. This should result in a more receptive attitude by Dr. Eggers and OART and should be accomplished before the presentation to Dr. Eggers.
4. Because of the limited time available, (presentation should be made by mid-January), AERO will develop the necessary data and P&VE review and concurrence in the structural aspect of the report should be obtained.

ACTIONS ASSIGNED:

1. Dr. Geissler will arrange for preparation of the presentation utilizing primarily AERO personnel, but calling on Mr. Richard, Mr. Maus, and others, for specific support as required.

D-2
(A)

2. Mr. Cook will advise Mr. Cline of the effort and the need for P&VE review.
3. Mr. Weidner will advise Dr. von Braun.
4. Dr. Geissler will contact Dr. Eggers and establish tentative date for presentation.

P. C. Read

cc:

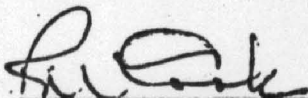
Attendees

R-DIR, Mr. Weidner

R-DIR, Dr. McCall

R-OM-DIR, Col. Fellows

CONCURRENCE:



R. W. Cook

14 DEC 1965

December 10, 1965

MEMO FOR RECORD

Subject: Comments of Dr. Eggers at MSFC on December 3, 1965

Following are some comments which may supplement your own notes on this visit.

Technical Interchange between NASA Centers. Dr. Eggers made a strong, at-length pitch on the need for continuous in-depth, technical, contacts between working people among NASA Centers. "We must keep working on techniques to get real-time, person-to-person inter-action between the centers. A personal relationship is essential Years ago such a relationship was non-existent, and I do not believe the situation has improved. . . . For example, if you still have problems in the aerodynamics area, you should be talking to Ames, and today you are not talking to Ames." Mr. Weidner suggested that Dr. Eggers make a presentation to MSFC laboratory personnel about the need for inter-action among technical people in all the NASA Centers.

High Reynolds Number Facility. Dr. Eggers said that there are two ways to look at the need for this facility. First, the Saturn problems which this facility would attack are not pacing, and it is a reasonable risk to proceed with the Apollo program without such a facility. Second, the problem is critical and could cause failure of the Apollo program. If this is the case, NASA top management must take a look. Dr. Eggers believes the problem is not that critical.

Dr. Eggers was skeptical about the contribution of this facility to Apollo. Because it will be three years before we can get meaningful data from this facility, what will the facility contribute to the Apollo program? Saturn IB will fly with man before this facility is ready. What are we doing for IB in lieu of this facility? Is what we are doing enough to make us feel reasonably sure that we can man-rate the IB? What effect do these "stop-gap" measures have on Apollo hardware and operations? How worried are we, really, in areas such as reliability, structural integrity, payload penalty, etc.? We must have quantitative answers to these questions. We have never seen such quantitative answers. Nor have we seen how the IB is instrumented to measure some of the things this facility would measure. There is a void in the data needed to make a good case for this facility.

These are fair questions because we have had good success on launch vehicles in this country from a structural standpoint. Just what is it that is peculiar to IB and V that requires additional data in this area?

OK-MC
info.
the data
copy to Mr.
(AT)
D-2

If such a facility is required, is the one presented here the best facility we could build to work on these problems? We must think beyond Apollo and think of future programs as well. NASA has not addressed itself to this. It must be part of the presentation. This presentation should be made to the ART Centers. Dr. Seamans cannot resolve the need for this facility because technical people of equal competence have honest differences of opinion. Technical groups from the Centers must meet together and arrive at a common understanding of the problem and the alternatives for solution. The issue must be approached as a broad-based problem for future launch vehicles, and not merely as a facility to solve the immediate problems of Saturn V.

The problem is not getting the attention it deserves in ART. The presentation today is based on data developed many years ago. The Ames Center has moved on to other problems. Perhaps this subject warrants new attention, and we should get them back in the act. Dr. Eggers volunteered to be the focal point to get ART working on this again. He will personally take the matter up with Ames and Pearson.



Ray Kline

cc:

Mr. Gorman
Mr. Neubert
Mr. Shepherd
Mr. Weidner
Dr. Geissler
Mr. Dykes

NOTES 2/14/66 BALCH

2/16

B 2/18

S-II-T Stage - Successful proof pressure and flow tests on side wall insulation have been completed, and setups are presently being made for testing the forward bulkhead insulation next week. Stage power-on tests successfully completed, with no problems on the stage and only minor problems on the GSE. The GSE single point ground is being reworked. Channelization and other final preparations for LN₂ tanking are continuing. In a meeting with MSFC/P&VE and S&ID personnel, technical agreement was reached on the unresolved problem areas pertaining to the LN₂ tanking test. ✓

S-II Test Stand A-1 GSE - The 90 per cent design review for this installation was completed on 2/10/66, and S&ID has a target of 3/15/66 for finalizing a subcontract with work to start on 4/1/66. ✓

S-IC Test Stand and TCC - Topped out structural steel for superstructure of center pier. Started hanging siding on north side, center pier, on 2/8/66. Acceptance checkout of the RCA 110A computer was completed on 2/5/66, and modification kits are being installed. ✓

Technical Systems, Phase I - The data handling system for the DHC has arrived and is expected to be installed and ready for checkout about 2/18/66. ✓

Technical Systems, Phase II - Responses to RFQ for installation of S-II Test Stand A-1 cable trays have been received, and RFQ for the balance of S-II Test Stand A-1 technical systems installation was released to bidders, with a due date of 2/25/66. S-IC controls cable to be provided by IT&T is late and may affect the S-IC installation schedule. ✓

High Pressure Gas System - Tests of hydrogen pumps have again been conducted, and pumps would not produce the required pressures. The contractor dismantled the pumps and no major trouble was discovered. They have now been reassembled and will be tested again starting 2/14/66. ✓

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98211

B
2/18RL10 ENGINE

We met with the Navy on February 3, 1966 at West Palm Beach to work out ways to accelerate the phase-in of their personnel.

Engine and component tests were curtailed and terminated in certain areas last week due to the hydrogen shortage caused by the shutdown of the hydrogen plant at MTF. ✓

F-1 ENGINE

The Qual II type injector has been bomb tested at thrust levels above end of flight conditions as a part of the limits tests investigation. Damp time for each test was 15 milliseconds or less (single cycle). ✓

Status of strike at RETS, EAFB.

Although the union employees remain on the job, negotiations have apparently broken down. The President's "Missile Sites Commission" has scheduled a hearing starting February 14, 1966. This commission cannot decide conflicts nor order actions, but it has great influence. ✓

H-1 ENGINE

The first 205K Quality Assurance Test engine has been disassembled and will be on display at Canoga Park from February 14 through February 18. Following the display, this engine will be rebuilt for use as a vehicle spare.

Release of the improved LOX seal to production is expected this month. Production effectivity will be SA-209 and subsequent. Retrofit effectivity has not been established as of this time. ✓

J-2 ENGINE

An S-II Battleship test of February 7 was terminated after 336 seconds due to a fire in the area of the position four engine. The fire resulted from an engine augmented spark igniter LOX line failure at the LOX dome flange. There was no additional damage to the engine and stage damage was restricted to wiring in the position four area. The infra-red television monitoring system permitted immediate detection of the fire and minimized damage.

A decision has been made not to put the Titan III engine into the J-4 test cell at AEDC prior to starting the J-2 test program. ✓ We are presently investigating the possibility of improving the J-2 program schedule at AEDC. ✓

GENERAL

Rocketdyne has indicated a shortage of critical materials on our engine programs due to DOD priorities. It looks as though future orders of the J-2, F-1 and H-1 engines will require up to 50 percent additional lead time. We are working this area to arrive at a clear understanding of the real impact and possible action to minimize the impact. ✓

1. FAILURE OF S-IVB COMMON BULKHEAD STRUCTURAL TEST SPECIMEN: Investigation of the S-IVB Common Bulkhead Test Tank (CBTT) failure is proceeding at DAC. Primary efforts at Huntington Beach are being placed on reduction and evaluation of test data. The failed specimen has been carefully disassembled and shipped to Santa Monica for metallurgical and fracture mechanics examinations.

Preliminary information indicates that a design deficiency (rather than a manufacturing or quality error) possibly exists in the joint area. This is the area where the common bulkhead is attached to the aft bulkhead. The failure appears to have occurred in the compression instability mode at approximately 106% of negative (collapse) delta pressure, compared to a test goal of 140%. Since a series of events must occur simultaneously to develop this condition, this delta-pressure level is conservative. However, DAC has designed the common dome to withstand the 140% value, and therefore the integrity of this structure remains undefined.

The Structures Division has formulated a list of items which are recommended for DAC evaluation as a part of the failure investigation. Representatives of the Strength Analysis Branch will visit DAC during the two week period of 2/7-19/66 to monitor and participate in the failure investigation and to review in detail the procedures and progress of the DAC stress analysis of the common bulkhead joint (i.e., CBTT failure area).

2. ACCUMULATOR LEAKAGE PROBLEM RESOLVED: A number of accumulators on S-IB-1 and S-IB-4 have been leaking air from the precharge side to the low pressure reservoir. Disassembly of units and controlled testing had failed to indicate the leakage mode. Tests run by the supplier (Cadillac Gage Co.) produced considerable leakage when the unit was precharged in 7 seconds while conditioned at 20°F. This leakage is caused by stiffening of the sleeve O-ring due to the low temperature where the fast precharge does not allow adequate response time for the O-ring to seal. A slow application of the precharge should resolve the problem. ✓

FLOOD CONTROL WORK

9/2/16

We are informed that agreement has been reached between the New Orleans Levee Board and the Corps of Engineers on the immediate measures to be taken to furnish additional protection from flooding to the Michoud Plant in the event of another severe hurricane.

The Levee Board will raise the north levee of the Intracoastal Canal between Paris Road and the Industrial Canal and the East Levee of the Industrial Canal between the Intracoastal Canal and the L&N Railroad to a height of 13 feet 0 inches. Work should commence on or about March 1, 1966, and should be completed by mid-August 1966. The money expended by the Levee Board in this endeavor will be credited as part of their contribution to the total flood control effort being performed by the Federal Government and the local agencies.

The Levee Board, on its own, will raise the existing levee east of the Michoud Assembly Facility along the north edge of the Intracoastal Canal to an elevation of 11 feet to a point where this levee crosses the L&N Railroad tracks. This work should be completed by mid-August.

Work has already commenced on improving the Levee along Hayne Boulevard from New Orleans Airport to Paris Road and this work will be completed by mid-August.

This plan is consistent with the proposed work described by the Levee Board to General O'Connor and party in January. Mr. Art Daly, I-FP, has maps in Huntsville which further illustrate this proposed work. ✓

NOTES 2-14-66 DANNENBERG

B 2/18

102116

1. MSFC Liaison Activity at MSC - According to Mr. Davidson's summary report on the second year's operation, the MSFC Liaison Office provided coordination assistance and/or information interchange between the two centers on a total of 881 items, along with lodging and transportation assistance for 191 MSFC visitors to MSC. This compares with 546 items and 107 visitors for 1964. A tabulation of these items by year, organization, and number is as follows:

	<u>1964</u>	<u>1965</u>
<u>MSFC Requested Items</u>		
R&DO	167	169
IO	55	153
DIR	18	32
PA	<u>2</u>	<u>10</u>
Total:	242	364
<u>MSC Requested Items</u>		
Total:	184	356
<u>MSFC Liaison Initiated</u>		
Total:	116	160
<u>Misc. Items (AFLO, Langley, LASL)</u>		
Total:	<u>4</u>	<u>1</u>
	546	881

The 1965 operation represents a more even balance of items coordinated between the two centers than in 1964 and an almost equal balance of items coordinated for R&DO and IO at MSFC. ✓

2. Data Management - In order to reduce the amount of existing documents, R&DO requested IO to cancel the following Saturn I/IB documents which were being prepared under the System Integration Support contract with Chrysler Corporation:

Technical Information Handbook ✓
 Vehicle Data Book ✓
 Design Data Manuals. ✓

NOTES 2/14/66 FELLOWS

B 2/18

9/82/14

1. Computation Laboratory Single Support Contract: The Preproposal Conference for Computation Laboratory support requirements was held on February 9. Twenty-three firms were represented. Major companies/corporations represented are:

Booz-Allen	ITT Research
Burroughs Corp.	Litton Industries
Brown Engineering Co.	Ling-Temco-Vought Aerospace Corp.
CEIR	MESA Scientific Corp.
Computer Sciences Corp.	Northrop Corp.
Consultants & Designers	RCA
General Electric	Reynolds Electric
Gulton Industries	Systems Development Corp.
Information Systems, Inc.	Telecomputing Systems, Inc.
Lear Siegler, Inc.	Tracor, Inc.
Minneapolis-Honeywell	Wolfe Research & Development

Proposals are due March 14. The estimated effective date of the contract is July 1. The continuity of services clause provides for a two-month phase-out, phase-in of the incumbent and the selected contractor, commencing on the effective date of the new contract. The grapevine indicates that as many as six firms may submit proposals. ✓

B 2/18

9/18 2/14

1. Saturn IB Current Performance: The Saturn IB AS-207 vehicle is now firmly established in the 40,000 pound payload class, based upon the February 1966 current weights and vehicle characteristics. Due to a reflection of the S-IVB-1 actual instrumentation weight into subsequent vehicles, the S-IVB dry weight of vehicles AS-205 and subsequent was reduced approximately 590 pounds. This, plus other weight reductions in the S-IB dry weights and S-IVB thrust buildup propellant, increased payloads on vehicles AS-205 and subsequent on an average of 630 pounds. The Saturn IB vehicles and their current performance capabilities are listed below:

Vehicle	Feb. Payload (lbs)	Payload Increase from Jan. (lbs)	Apollo Commitment (lbs)	Payload Margin (lbs)
AS-203	20,853	+43	19,400	+1453
AS-204	36,513	+40	35,300	+1213
AS-205	38,820	+638	35,300	+3520
AS-206	39,733	+628	36,200	+3533
AS207	40,228	+626	38,100	+2128

2. High Reynolds Number Test Facility: We are now ready to give to Dr. Eggers the follow-on presentation on our proposed High Reynolds Number Test Facility. The presentation will repeat our technical arguments for the need of this facility, and give in addition its impact on the Saturn V/ Apollo program ("closing the loop of our argument" as Dr. Eggers had phrased it). Our results show a very sizeable potential cost and schedule impact through operational effects. The presentation will be on March 8, 1966. You may want to have an advance briefing yourself. We would appreciate it if you would contact Dr. Mueller (possibly at the SA-201 launching) to secure his support and have somebody from his office attend the March 8 Meeting. This would be particularly important if the question of "why locate the facility in Huntsville?" should come up. We do not intend to broach this question, but the other side might. I enclose again the briefing package* I sent you before.

* Transmitted separately.

Yes, please arrange
B 2/18

CONFIDENTIAL

Shap
Please check
& ask suitable MTF
man to participate B
in Washington,
I suppose.
B

P 2116

1. AUTOMATIC CHECKOUT: In answer to the old question, why do we automate the checkout when some believe it can be done faster, cheaper, and better in a modified manual mode, I would like to reiterate: (a) The computer can operate much faster than a human, thus reducing the percentage of "useful life" used in the checkout of flight hardware. (b) Development of an efficient automated checkout requires a greater degree of early planning and system analysis, which enhances the early detection of problem areas. (c) The computer is able to neutralize unsafe conditions before a human could recognize that the condition existed. (d) The computer always reacts to a given situation in exactly the same way - humans do not. (e) The computer can "pay attention" and compare against a standard many more functions and variables than a human can, it can constantly screen these and present for human decision only those which do not meet the standard. (f) The computer can reliably and exhaustively document everything it does, thus permitting "post-mortem" analysis and learning which is impossible in manual systems.

The additional confidence in the reliability of the end item, gained by going automated, does not come free. The system must be de-bugged for its initial use which takes time. However, once this is accomplished, testing of a more thorough nature can be done in a timely manner which increases the confidence in the performance of the flight hardware.

Another aspect of automation is that it requires the retraining and reeducation of competent, experienced personnel who resent being forced to change their familiar way of doing things, and who may therefore impede successful operation of the system. I feel we may have failed with this retraining, and as a result must constantly rejustify the automation program whenever we get in trouble, such as is happening on the S-II. The real problem facing MSFC today is not why we do automate checkout and launch; this has been thoroughly discussed many times, documented in hundreds of documents and is now history. The real issue is that we did go completely automated throughout the Saturn IB and Saturn V Programs, we have these systems defined and installed in all the stage contractors' plants, static firing and launch sites, and we must cease this effort of a small minority seeking ways of not utilizing this equipment to its fullest extent. The success or failure of these programs rests with those responsible for the application of this equipment to make it work and work properly as it has been done at Douglas, Chrysler, IBM and Boeing.

2. S-II PROGRAM: With the constant exercising on the S-II (manual vs. automatic at MTF, incentivizing S-II-T static firing, test and checkout of S-II-1 at Huntsville, etc.) we are diluting our efforts to such an extent that we are affecting our ability to get on with the planned program. We do not have the manpower to constantly rejustify and reevaluate events leading to prior decisions and to constantly shift gears.
3. S-IVB 501: This stage was removed from the checkout tower on February 1, 1966, to begin modifications. All testing previously accomplished has been invalidated by the rework. All confidence previously obtained from manufacturing checkout has been destroyed.

AS 2/16

1. SATURN V SYSTEMS DEVELOPMENT FACILITY (SDF): Since the Saturn V SDF is of utmost importance to the success of the Saturn V Program, some serious problems in the operation of the facility have to be pointed out. It is apparent that the Boeing Company is operating differently under their contract than the Chrysler Corporation on the Saturn IB contract. To activate the Saturn IB SDF and give full support to KSC to debug and verify the 201 software programs the Chrysler Corporation had 94 people in the Saturn IB Breadboard. Based on the SIB SDF experience, Astrionics estimated the manpower need for the Saturn V SDF would be 170 people. The Boeing Company has at the present about 480 people in the Saturn V SDF. The Boeing Company has the full backing of Industrial Operations to employ as many people as they see fit to fulfill their scheduled obligations. (GE deliveries were generally met to get Boeing started with subsystems GETS checkouts.) Astrionics experienced two reorganizations of the Boeing Management with exchange of supervisory personnel in the SDF in the past 10 weeks. We have no influence on SDF activation and operation. Our suggestions fall on deaf ears. Boeing is apparently not willing to accept our experience gained during the Saturn I and IB SDF Operation. Boeing applies a glorious management scheme, wasting a tremendous amount of manpower and, therefore, MSFC's money. The nature of this operation will not give MSFC the flexibility we need to respond to the frequent changes, such as R&DO changes, KSC inputs and work around necessities. This situation, as visualized by Astrionics, has been pointed out several times in the past weeks and discussed with IO (Colonel Murphy and most recently Dr. Rudolph). Dr. Rudolph informed Astrionics that the areas pointed out (Manpower application and Boeing cost) are outside of our assigned responsibility and should not be of any concern to Astrionics. However, we do not see how the hoard of manpower can be efficiently utilized in the Saturn V SDF to investigate and simulate the over-all Saturn V electrical system in time prior to its implementation at KSC. The SDF operation will be so cumbersome and time consuming that any reaction to R&DO requirements cannot be met and KSC needs, as a result of their tests, cannot be investigated as needed for our scheduled missions. We still hope we can obtain a solution to the described problem in R&DO/IO discussions.

2. S-IU-500FS PROGRAM: Checkout of the 500FS IU was finished 2/11 on schedule. ✓
Although we had a project with no priority we were still able to finish on time. The 500FS IU shows lower electromagnetic interference despite the fact that the number of shielded cables has been reduced by 50%. ✓ We do not yet have a good explanation for this result but we hope that we can reduce the number of shielded cables in other IU's. ✓

2/16 JJS

S-IC

The S-IC-1 stage propellant load test was successfully accomplished on February 8, 1966. The engines were lowered and re-installed after removal of the suction line screens. The screens were clean. The stage lox tank was inspected and found relatively clean. The first static firing is scheduled for February 17, 1966. ✓

VEHICLE S-IVB-203

Pre-static checkout of Vehicle 203 was completed on Wednesday. The mock countdown began at 7:00 a.m. Friday morning and was completed Saturday, with data evaluation in progress. DAC plans to initiate the final countdown Tuesday, February 15, 1966, with a full duration acceptance firing to follow on Wednesday, February 16, 1966. ✓

VEHICLE S-IVB-204

Pre-static activity is increasing with propulsion system checkout beginning on Friday, February 18, 1966. No major problems or discrepancies have thus far occurred. The March 15, 1966, firing date appears firm. ✓

S-II

→ A 336 seconds static firing was conducted at the S-II Battleship Facility at 10:15 a.m. PST on Tuesday, February 8, 1966. A fire on Engine No. 4 was detected at 3.5 seconds before cutoff. The fire was traced to blown ASI lox line at the lox dome weld connection. The fire was fed with GOX and fuel feeding back through the dome. Cutoff was initiated automatically when instrumentation circuit breakers were blown due to burned instrumentation wires shorting. The loss of instrumentation power caused the stage pre-valve to indicate that the pre-valve had left the open position. S&ID still has the interlock to give cutoff if the pre-valve leaves the open position. This is the second time a line failure has occurred at a weld connection with this set of engines on long duration test. ✓

SATURN V SERVICE ARM

The S-II Aft Service Arm was shipped by truck to the Cape on February 12, 1966. Operation of the arm was not completely satisfactory as difficulty was experienced with the cylinder-lever arm bearings. A tested fix will be installed at a later date. ✓

Kare H.

This line failure can cost us a Saturn V flight à \$100M.
Have we critically reviewed the design of these augmented spark igniter lines?

B

NOTES 2-14-66 HOELZER

B 2/18

1. SINGLE SUPPORT CONTRACTOR: A bidders' conference was held February 9, 1966, in the Morris Auditorium for the new Computation Laboratory single support contract. Twenty-three potential bidders attended the conference. This indicates much more interest for the new contract than was expressed two years ago when the present General Electric support contract was let. At that time, only two bidders - CEIR and General Electric - replied to the RFP. Proposals are due in on March 14, 1966. ✓
2. LIEF/HOSC COUNT DOWN DEMONSTRATION: LIEF/HOSC has been supporting the Count Down Demonstration of the complete SA-201 vehicle with some encouraging results. During this test on February 9, the power failed three times. These interruptions shut down the computer and caused a loss of data. Plans are to have backup power for the third generation computer system; however, we will continue to be susceptible to this type of failure until this backup is provided. ✓

NOTES 2/14/66 JAMES

B 2/18

9/25 2/16

AS-201: The Flight Readiness Test was completed Saturday with a minimum of difficulty. ✓ It now appears that we have only a few minor problems to correct prior to beginning propellant conditioning at 4:00 PM, Tuesday, February 15. ✓ It appears that we are on schedule for a 23 February launch. ✓

VLF 37-B: Last week I reported damage to some DDAS panels which occurred during shipment to KSC. G.E. was able to rapidly effect repairs with no schedule impact. ✓ Only one DDAS rack needed for GETS remains to be shipped. It should be shipped tomorrow and G.E. is still pressing for a 28 February sell-off of this equipment. ✓

I.U.-202: I.U.-202 was loaded aboard the Barge Palaemon and departed at 10:00 PM, Friday, 11 February. It should arrive at KSC approximately 22 February. ✓

SA-203: The Instrument Unit currently appears to be the pacing item for SA-203. Because of this, I have assigned Mr. George B. Hardy of my office to work practically fulltime in an attempt to hold or accelerate the current schedule. Besides needing improved effort on the part of IBM, we have two critical in-house problems. Our GFE is lagging in delivery and much effort is required to improve this. In this connection we are particularly appreciative of the major effort that R-Qual has devoted to this problem in the last few days. The other item is a late definition of changes which impact hardware. We will need a major effort by all concerned to solve this problems. We have asked Mr. Kroeger, R-ASTR-DIR, to assist us. ✓

9582114

S-II Welding Program Analysis: Manufacturing Engineering Laboratory personnel have recently updated their assessment of NAA-S&ID's welding program. In our judgment, at this time there are two basic areas requiring attention and strengthening at NAA as related to welding.

a. The first one is an organizational problem which requires approximately six S&ID organizations to contribute to their welding complex. These organizations admit to some assumed responsibilities, overlapping functions and lack of a central qualified authority to effect an efficient exchange of needed information, and assume primary responsibility for areas of organizational indecision.

b. The second problem is evidenced by lack of a completely thorough metallurgical and testing program which has permitted NAA-S&ID to select less than optimum weld schedules, use of less than optimum weld filler wire for repairs and control of weld repair procedures.

A major improvement to both problem areas can be effected by a top NAA management review of the complex welding organizational structure and assignment of a central qualified authority to effectively guide NAA-S&ID in definition of detailed organizational responsibilities and then guide these groups through problem areas to permit their effective endeavor.

The two areas of our concern have been discussed with all S&ID organizational segments involved in a meeting at S&ID a week ago. ✓
S&ID management is now aware of these problems so that improvements are now expected. Our studies on the weld wire problem will be summarized in a report to S&ID. ✓

NOTES 2/14/66 MAUS

B 2/18

JS 2/10

1. MSF REVIEW OF R&D POP 66-1 - We were advised Friday that the possibility of reduction in MSFC funding for FY 66 has not been discussed with Dr. Mueller. Current plans call for a normal MSF POP review on February 16, with the results to be reported to Dr. Mueller when he returns on February 17 or 18. Indications are that before final decisions are made that there will be discussions with Center Directors, probably by telephone rather than in a formal session as previously planned.

. Present target date for completed MSF POP 66-1 in Dr. Seamans' office is February 28. ✓

2. MSF REVIEW OF AO POP 66-1 - Messrs. Heater, Johnson and Kahao from MSF were here on February 7 and 8 and reviewed our AO POP 66-1. They disagreed with our contention that we need \$1.7M over the authorized FY 66 ceiling. They took the position that Marshall must make every effort to live within the FY 66 dollar ceiling of \$128.6M. They did agree, however, to take another look during the early 4th quarter. ✓

HM

I did
discuss
the questions
raised in
Ed O'Connor's
TNX with
FEM
prior to
his 2-17
meeting, —
so little
avail.

B

B 2/18

NOTES 2/14/66 RICHARD

9/82/16

201 Launch Preparations: The vehicle and ground systems supported the Flight Readiness Test in good fashion on the 12th. Our software and hardware and the launch crew's use of them seems to be O. K. ✓

201 Plugs-out Overall Test Analysis: IBM analyzed the data handled by the ground system during the plugs-out overall test to see what the traffic was. The results are somewhat interesting. The system responded to 5858 panel switch commands; it gave 6445 panel indications (lights, etc.); it displayed 21,000 display monitor messages; it issued 5,190 discrete commands to the vehicle; it responded to 178,000 on-off changes in the vehicle system (relays, thermostats, etc.); it read 103,000 DDAS values, and logged over 1,350,000 words of operational history. The crew called in 52 test programs. It appears that they used practically all of the programming (124,000 instructions and tables) we provided for SA-201. ✓

We had not exercised the system simultaneously to this extent in the breadboard, and as a result of this traffic and simultaneous non-computer hardware problems, three programming problems occurred during the test. Since then we have duplicated this activity, and the problems which occurred have been found. We feel the software is in good shape. ✓

One might say these figures reflect a complicated vehicle system, but I imagine similar data from a Redstone might have been surprising. ✓

We still have a noise and configuration problem at the Cape which R-ASTR and LVO are working on. We can launch with it, but it should be cleaned up before the next firing. ✓

Special Topic: Saturn V ESE - Systems Development Facility (Breadboard) - Program Tapes

● In October of '65, all of the Saturn V ESE deliveries were many, many months behind schedule (in fact, some critical items were forecast to be delivered as late as August 1966 = six months late). The late Saturn V ESE deliveries were caused by: - priority of Saturn IB ESE - late sign-off of ESE final design - shortage of GE manpower. ✓

Today:

● Much of the schedule slippages have been regained. In fact, all required GE/ESE has now been delivered at both the Saturn V SDF and the IU Checkout Station at IBM. Additionally, we are going to complete ESE delivery to LC 39-1 in March. This recovery in schedule was accomplished by: - many, many long hard hours by Saturn V and Astrionics people - deletion of factory GETS - authorizing GE to sub-contract numerous tasks - hire of new employees and TDY of many GE people - 75-80% overtime by GE. ✓

● The original and current Saturn V SDF schedules reflect the following:

	<u>Original Schedule</u>	<u>Current Schedule</u>
Installation	39 wks	10 wks
Sub-System GETS	15 "	4 "
Integration GETS	8 "	2 "
Vehicle/ESE Integration	4 "	2 "
Total Time	66 wks	18 wks

Since the GE/ESE delivery to the Saturn V SDF did not begin until early January '66, and we received no schedule relief on requirements for producing operating and test program tapes for 500F, we have had to again revert to a drastic reduction in time allowed for SDF integration and checkout. Consequently, we are requiring Boeing to complete their effort in 18 weeks (see above). The attempt to make such a target schedule requires: - many people - long hard hours - the determination to want to do it. I am, however, repeatedly being criticized for reducing the Saturn V SDF schedule and at the same time, I am also being criticized for putting too many Boeing people on the Saturn V SDF. | 1 hour B

We in Saturn V have directed Boeing to make the schedule; therefore, they brought many of their people to the SDF from other required tasks on temporary assignments (trade-off). As certain skills are required on the SDF during February and March, Boeing will continue this practice and also must work 80-85% overtime. Our equivalent man months reached 850 last week and will continue at this rate through March '66. ✓

● I plan to: - get the job finished on schedule - modify all required ESE at the Saturn V SDF to insure correct ESE at LC 39 - then reduce Boeing manpower when each task is completed at Saturn V SDF. ✓

NOTES 2/14/66 SPEER

B 2/18

9/10 2/16

1. AS-202 GROUND SUPPORT: The addition of the flight test of the S-IVB Common Bulkhead experiment on AS-202 has placed increased emphasis on ground support of the launch vehicle after separation. A ship will be required to supplement available ground coverage. MSFC support requirements have been established and will be levied through OSRO. ✓

2. AS-201 LIEF ACTIVITIES: LIEF and the Huntsville Operations Support Center (HOSC) were activated throughout the re-run of the Countdown Demonstration Test (CDDT) on 2/9/66 and the Flight Readiness Test on 2/12/66. The Data Display System was fully activated and Engineering Consoles were manned. Real time data was monitored including the J-2 chilldown sequence at T-200 minutes of CDDT. This sequence was of special interest because of its relation to the prelaunch checkout redline parameters. The CDDT represented the first full scale support operation performed in the new HOSC and valuable operating experience and system performance confidence were gained. ✓

3. SUPPORT REQUIREMENTS: A meeting was held on 2/10/66 at Patrick Air Force Base to resolve photographic implementation problems. MSFC and MSC will be given special consideration on AS-201. However, both Centers will receive only 1 print of their requested footage on all other flights. Additional copies will have to be funded by the requesting Centers. During this meeting it came to light that OMSF has not planned for funding of any IB and V support requirements not covered in individual Center budgets. Since MSFC has not budgeted for any such requirements, and KSC appears unable to satisfy all requirements being levied, it now appears that there is a problem in this area. ↗

F.S., I'm sure you'll solve it, though
B

B 2/18

908 2/16
Stuhlinger

1. PEGASUS: The solar panel voltage on all three spacecraft has been gradually increasing in value and giving evidence that the Zener diodes that are used for initial regulation are beginning to deteriorate somewhat. By switching from the standard mode to the alternate, thus changing Zener packs on Pegasus I and III, the voltage regulation improved. Pegasus II was scheduled to be switched February 11th. ✓

A problem was encountered with the FM transmitter #2 on Pegasus III which may be a major shift in carrier frequency or a failure in the output stage. This is under investigation; meanwhile, FM transmitter #1 is functioning properly. ✓

As you may have read in the Huntsville Times, Project Pegasus came under Congressional criticism recently. The main argument was that so many subsystems and panels have failed that the meteoroid data are almost useless. We are furnishing M. Ames now up-to-date detailed data on all panel thicknesses of all three Pegasus spacecraft which will enable him to counter-argue this accusation. In fact, the three data points are now established with a one-sigma value of about 4% (0.04mm); 14% (0.2mm); and 7% (0.4mm). Even if all the subsystems and all the panels had worked perfectly throughout the three one-sigma errors would still be 3.6%, 7.5% and 5% respectively. In view of the highly statistical nature of the meteoroid phenomenon, the degree of precision which Pegasus has obtained by now is sufficient to provide spacecraft designers with adequate data in the thickness regime investigated by Pegasus. ✓ It is true, however, that more data would probably enable us to say a little more about a possible directionality of meteoroids in the vicinity of the earth. ✓

Pegasus I will have its first anniversary in orbit this Wednesday. ✓

2. TRANSFER OF RESEARCH PROGRAM OFFICE: When RPL's involvement in AAP-type activities increased very strongly during the last year, I requested Mr. Weidner to help me gain more time for AAP by transferring the Supporting Research and Technology Activity (i. e. Gentry Miles' Research Program Office) into a R&DO Staff Office. ✓ This transfer would also solve the old problem of "split loyalty" which exists when the Director of a Laboratory is at the same time the manager of the MSFC Supporting Research and Development Program. ✓ Mr. Weidner recently decided to assign the Research Program Office as a R&DO staff function to Dr. W. G. Johnson. Although the formal transfer of the office to the R&DO Staff will take place later, Gentry Miles will begin to report to Dr. Johnson, and Dr. Johnson will begin to exercise the overall RPO Management function, as of February 14th. This transfer includes all of Gentry Miles' associates, and also Mr. W. Cannon, who has been devoting his full-time effort to research program activities during the last four months. ✓

I am preparing for you a short summary report on the development and accomplishments of the MSFC Supporting Research Program which began in February 1956, ten years ago this month. ✓

9682114

1. Saturn IB Growth Potential Briefing. We presented to Del Tischler and associates last week a briefing dealing with Saturn IB growth potential, and particularly the comparison of the 260-inch solid plus S-IVB vs. Saturn IB with solid strap-on. The briefing and discussion were seemingly "accepted as information" by Del and the people that were with him. The large solids people from Del's office were not with him on this visit; he requested that they be given a chance to review our material and discuss it with us later. We will do this.
2. Local Scientific Survey Module. On February 9 and 10, 1966, meetings were held here with Boeing and Bendix respectively to review material generated to answer Dr. Mueller's questions on LSSM. Due to the volume of data presented, a LSSM technical panel meeting will be held at MSFC on February 24, 1966, to discuss and develop a summary for presentation to Dr. Mueller. It presently appears that we can offer a wheeled mobility device from \$17M up to \$100M depending on the equipment, performance, and reliability desired.
3. Mission Planning Task Force. During the luncheon meeting in Dr. McCall's office on February 9, 1966, Mr. Taylor (MLA) discussed the intended function and role of the Manned Space Flight centers in support of OMSF in AAP Mission Planning. He emphasized the importance of strong Center participation in mission planning. To date MSFC has only kept a foot in the door for MSFC in this area. With the preliminary PPDP and AAP Directive #1 out for comments, and the discussion with Mr. Taylor, we should have a good feel for the need for MSFC's strong participation.

FEBRUARY 21, 1966

NOTES 2/21/66 BALCH

S-II-T Stage - Retest of forward bulkhead insulation, fitup of insulation closeouts around LH_2 prevalues and recirculation valves, and leak detection functional checkout are expected to be complete early next week. Problems with GSE single point ground were more serious than they first appeared and have been referred to S&ID, Downey, for resolution. In addition to achieving a satisfactory grounding condition for the GSE, it has now been established that a large number of circuits must be fused prior to the electromechanical checkout, which in turn restrains preparations for the LN_2 tanking. First firing of the S-II-T is presently scheduled for March 22, 1966, and total potential slippage is estimated at six days.

S-II Test Stand A-1 - Approximately 60% of the structural steel required has been received, but inspection by the Corps of Engineers has revealed a large number of defective welds in over one-third of this. Supplier, contractor, and Corps of Engineers are in the process of determining the most expeditious way to repair these welds to minimize schedule slippage. Corrective action has been taken to prevent shipment of additional steel with defective welds.

S-IC Test Complex - Installation of modification kits on the RCA 110A computer was completed on February 11, 1966, and documentation is being prepared to turn over custody of the computer to Boeing.

Technical Systems, Phase II - Acceptance checkout of the DHC Analog Loop Tape Recorder System was started on February 10, 1966, and completed on February 14, 1966. Checkout of the One-Third Octave Analyzer System was started on February 16, 1966, and is continuing. Current IT&T schedule for supplying S-IC controls cable will support only a 40-hour work week by the installation subcontractor and barely provide for meeting the need date.

High Pressure Gas Systems - In tests of hydrogen pumps conducted on February 14, 1966, pumps again failed to meet requirements. Contractor now plans to dismantle a pump on the west coast identical to those at MTF to try to resolve the problem. On-ground gas systems for S-II Test Stand A-2 were turned over to S&ID on February 16, 1966. Charging of the hydrogen storage bottles for the S-II Test Stand A-2 was started on February 17, 1966.

F-1 ENGINE

Replacement of fuel inlet elbows on all five engines of S-IC-1 while in the static test stand was accomplished. S-IC-2 and S-IC-3 engines will be reworked in the same manner.

RETS strike hearings by the President's Missile Sites Commission broke down and the parties (Union and Rocketdyne) returned home. The commission is reviewing records of previous negotiations and the full commission will meet on the disagreements March 17, 1966, thus providing a "cooling-off" period. Union and management agreed to continue uninterrupted work pending full commission decision.

The Quarterly Technical Program Review with Rocketdyne was held at MSFC during February 16 thru 18, 1966.

RL10 ENGINE

Intermittent operation of the hydrogen plant at Michoud prolonged the LH₂ shortage. A reduced quantity has been approved for delivery to P&WA to accomplish priority tests in support of the Centaur AC-8 launch and the production engine program. Six firings were conducted last week on the E-5 dual engine test stand to verify the AC-8 sequence and substantiate the LOX flow requirements.

J-2 ENGINE

A meeting was held at AEDC this week to investigate the possibility of improving the J-2 altitude verification program schedule. Representation from AEDC, ARO, MSFC, and MSF were in attendance. In order to improve the schedule, additional manpower is required by ARO. Completion of this evaluation is pending response from AFSC concerning raising the ARO manpower level.

Three J-2 engines were delivered this week, the second and third S-II 503 engines and an S-II spare.

H-1 ENGINE

Testing is almost complete on the modified LOX pump seal and the results to date have indicated zero leakage. Seven seals have been engine tested and three seals have been tested in turbopump pits successfully. A seal design review meeting has been set for Thursday, February 24, 1966.

NOTES 2-21-66 CLINE

NEGATIVE REPORT

NOTES 2/21/66 CONSTAN

Negative Report

NOTES 2-21-66 DANNENBERG

NEGATIVE REPORT.

NOTES 2/21/66 FELLOWS

1. R-DIR Review of R&DO Functions and Manpower Utilization:

(Refer to my 1/10/66 NOTES, attached) The manpower review of the P&VE Laboratory was performed February 16-17. Schedules for the other laboratories are as follows:

R-ME	Feb. 24
R-QUAL	Feb. 25
R-AERO	March 2-3
R-TEST	March 9-10
R-ASTR	March 16-17
R-COMP	March 24
R-RP	March 29
R-AS	April 5 (a.m.)
R-OM	April 5 (p.m.)

2. MSFC General Support to the Apollo Program: (Refer to my 2/7/66 NOTES, attached) In response to requirements established in Mr. Gorman's January 28 memo to Mr. Weidner, preliminary information has been pulled together for use in developing a plan to implement the general Apollo Support Program, and submitted to Mr. Gorman. Refinement of the data is continuing but it will be several weeks before it is completed because of the recent Headquarters budget reduction.

Loris Understood

NOTES 1-10-65 FELLOWS

3/1/65

9/2/74

1. R-DIR REVIEW OF R&DO FUNCTIONS AND MANPOWER UTILIZATION: R-DIR's current review of R&DO functions and manpower utilization with the laboratories and offices, will be oriented toward identification of the remaining Saturn requirements and the related skills and manpower needs necessary for support of these requirements. This will also enable us to determine our capability to undertake new work, and the reorientation in organization and skills that may be required for the AAP Program, In-Flight Experiments, Supporting Research & Technology, etc. The current review was initiated January 5 by Mr. Cook, who briefed laboratory representatives on the objectives and manner in which the review would be conducted. ✓
2. REVIEW OF MTF A-2 STAND: On January 5, a representative from this office visited MTF with a team, organized by Col. Yarchin, to establish a base line for design review of the A-2 test stand. (That stand is required for the S-II-T firing.) As a result of the team visit, a set of drawings, reflecting the as-built condition of the stand, will be received from S&ID in about a week and will be reviewed by R&D Operations for design adequacy. ✓

NOTES 2/7/66 FELLOWS

B2/12

2/7/66

1. MSFC General Support of the Apollo Program: The R-DIR review of R&DO's functions and manpower utilization, mentioned in NOTES 1/10/66 (attached) is being undertaken in a manner to be fully in accord with the guidelines and objectives established for this Program and associated accounting procedure. We are in the process of identifying resources available for this Program, including dollars, manpower, and materials and supplies on hand. ✓
2. R&D Initiations: During the past week, the laboratories have processed an additional \$10 million in procurement requests, bringing our total to \$127 million and getting us right on schedule with our initiation plan. ✓
3. Performance Evaluation Board Findings for Single Support Contractors: The three remaining single support contractors have indicated their acceptance of the Performance Evaluation Board's findings in the semi-annual evaluation and the Award Fee Findings and Determinations are being processed. ✓
4. Computation Single Support Contract: The Pre-proposal Conference for bidders for the support service contract for the Computation Laboratory is scheduled for February 9, 1966. Several companies are expected to participate. ✓
5. CCSD Proposal MD-107A: The preliminary review has been completed of the Saturn IB Vehicle System Integration Mission Support Proposal, MD-107A, prepared by CCSD for contract NAS8-4016. The review was conducted between R&DO and the IO personnel, and also included the contractor's management and technical personnel, so that the proposal could be reviewed in light of the MSFC/CCSD working relationship. Chrysler is now revising the proposal as an incentive contract; that proposal is to be received for MSFC review by the latter part of March. CPIF negotiations are planned for early April 1966. ✓

NOTES 2/21/66 GEISSLER

1. S-II Incentive Contract: NAA/S&ID agreed essentially to the R&DO Flight Performance Incentive Plan for the S-II stage during meetings at S&ID on February 7, 8, and 9. This plan, formulated by the Aero-Astroynamics Laboratory with the aid of the other R&DO Laboratories and IO, is the same type of plan which was formulated for the S-IVB stage, and which is being formulated for the S-IB and S-IC stages. It was developed to provide an adequate stage performance evaluation, and at the same time to minimize the manpower required to evaluate the contractor performance. S&ID is writing the R&DO plan into a contractual statement, which will be ready for final review and negotiation on February 21 and 22. IO has set up a meeting at S&ID to accomplish the final review and negotiation. A representative of Aero-Astroynamics will attend. The deadline for completion of negotiation on the flight performance incentive parameters has been set at March 1. Completion of negotiations of the total incentive contract, including cost, schedule, and performance, is scheduled for April 1, 1966.
2. Emergency Detection System Sub-Panel: An Emergency Detection System (EDS) Sub-Panel of the Flight Mechanics Panel has been formed, and is co-chaired by Mr. Carlos Hagood, R-AERO-F. Membership at MSFC consists of personnel from Aero-Astroynamics (3), Astrionics (5), P&VE (3), and IO (2). First meeting is planned for week of February 28, and it is anticipated that the membership will be reduced somewhat after the Sub-Panel tasks are well underway.
3. Saturn's Effect on the Ionosphere: Personnel of our Aerospace Environment Office are studying the effect on the ionosphere of the passage of Saturn Vehicles. A paper covering the launches of SA-6, 8, 9, and 10 was presented at the Second American Astronautical Society Symposium on Interactions of Space Vehicles with an Ionized Atmosphere, in Miami Beach, Florida, November 1965. The chairman of this meeting, Dr. Adolph Hochstim of the Institute for Defense Analysis (a contractor supporting DOD), was interested in the paper, and requested that we provide him with a copy of a literature survey of pertinent data available at MSFC. We have provided this information. He also stated that he was in the process of setting up a meeting in Washington concerning this subject, and that he would like MSFC personnel to participate. Preliminary evaluation of electron-density data from ETR ionosondes indicates an electron density decrease following the passage of SA-6, 8, 9, and 10 through the ionosphere. To define steady state conditions in the ionosphere immediately prior and subsequent to launches at the Cape, the ionospheric stations of the ETR have been requested to provide soundings at 15 minute intervals, 14 days prior to 14 days after launches, and continuous sounding data for the period 2 hours prior to 2 hours after each IB and V launch. In addition, Dr. Schmerling, OSSA, has contacted Mr. Roberts of the Aerospace Environment Office, about establishing a contractor operated ground station at MSFC to study the effects on the ionosphere of the static firings conducted here. Necessary formal funding requests have been made. Dr. Johnson is assisting us in preparing a program combining these programs with the general ionosphere program currently operated by RPL from the Green Mountain Station.

NOTES 2-21-66 GRAU

1. S-IC-2 CHECKOUT: Post manufacturing checkout of the S-IC-2 stage is on schedule. In order to accelerate checkout (completion now required March 22 instead of April 18), we have initiated a 14-hour workday and all possible tests are being delayed until post static checkout. Currently, the greatest obstacle to the March 22 completion date appears to be the availability of a few critical items of stage hardware. This hardware is being pursued consistently with both Manufacturing Engineering Laboratory and Boeing.
2. 500FS INSTRUMENT UNIT CHECKOUT: Checkout of the 500FS Instrument Unit was completed and the IU was released to Manufacturing Engineering Laboratory February 14, 1966. The checkout complex is presently being disassembled for shipment to Douglas Aircraft Company.
3. APOLLO METROLOGY CONFERENCE: The Quality Engineering Division of this Laboratory will act as host for the Apollo Metrology Conference to be held February 24-25, 1966. Participants will be from all Apollo Centers and from NASA Headquarters.

NOTES 2/21/66 HAEUSSERMANN

1. SA-203 IU TV and TM ANTENNAE: *(Reference Item 2 of my 1/31 Notes and Item 4 of Lee James' 2/7 Notes reprinted on the attachment). When IBM first assessed the change-out of the antennae it appeared it would be necessary to remove the cold plate. Because of very close cooperation between the RMO, the IU Office and Astrionics, a solution for the installation was worked out which did not require removal of the cold plate. Installation of the new antennae was finished 2/19.
2. NATIONAL ADVISORY GROUP FOR NAVIGATION, GUIDANCE, AND CONTROL: On 2/15 I participated as an observer in the first meeting since the NASA Flight Centers had been excluded from membership. All excluded Centers (plus JPL) were represented by observers. The meeting was at MSC and was called to discuss G&C trends in the next decade; it was worthwhile to participate.
3. MSC'S RESPONSE TO MANNED BOOSTER CONTROL EXPERIMENT AS PROPOSED BY AMES: Dr. Gilruth's letter, objecting to the experiments, had been written by Mr. R. Chilton (Deputy to Dr. Duncan) and promoted by Mr. Faget. In my discussion with Mr. Chilton, I learned that MSC is strongly opposing MSFC's recoverable booster ideas -- they would like to see a post-Apollo vehicle with 260" solid propellant boosters and one guidance and control system in the command module, which should be recovered. During OART's steering group meeting, MSC was strongly criticized for not participating in the Ames' tests and was requested to assign cooperating engineers and astronauts in the future. It was decided to continue the investigations to further prove which advantages can be obtained by normal control and guidance.

*Copies to DIR and R-DIR only.

NOTES 1/31/66 HAEUSSERMANN

A. SA-203 IU TV AND TM ANTENNAE: The original design of TV and TM antennae for SA-203 IU did not, according to test results performed on prototype, meet requirements for bandwidth. As a consequence, the original design had to be dropped. A prototype of a redesigned unit is being tested. Flight units of this new design will be delivered to IBM 2/14, still satisfactory for start of checkout. Full qualification will be completed 3/31. ✓

-NOTES- 2/7/66 JAMES

*Excer
James
1/11/66*

SA-203 IU TV AND TM ANTENNAE: (Ref. Dr. Haeussermann's Notes 1/31/66, copy attached.) The type of change mentioned by Dr. Haeussermann on the design of the IU-203 antennae continue to plague us in trying to meet an acceptable delivery date for IU-203. Most of the time it is not a question of the technical validity of the changes but rather a problem of untimely definition of the change. I believe we finally have IBM geared up to the proper sense of urgency on the IU's, but this contractor nor any other contractor cannot make schedules unless we develop and impose our technical requirements in a timely fashion. Dr. Haeussermann stated that the new antennae would be delivered in a time frame which would support the IU checkout date. He failed, however, to mention that it will be necessary to remove coldplates previously installed and make some changes to the IU structure which may very well delay the completion of assembly.

3/1/66

S-IC

Test S-IC-16 was successfully conducted at 3:18 p.m. on February 17, 1966. The mainstage duration was 40.8 seconds with test termination given by the firing panel operator as planned. The lox flowmeter in the suction line to engine position No. 2 was noted to have the bearing seized to the shaft and, therefore, a decision was made to remove the lox flowmeters for the next test, scheduled for February 25, 1966. Repairs are being made to correct deficiencies found in the actuator on each lox prevalue.

S-II BATTLESHIP

This week was spent in repairing the fire damaged hardware caused by the broken ASI lox line at the weld joint on Engine No. 4 during test 029. The weld failure was believed due to excessive wear and vibration. ASI lox lines on all other engines have been replaced. An attempt was made to conduct a LH₂ recirculation test on Saturday, February 19, 1966, however, loss of the valve can vacuum caused the attempt to be cancelled. A duration firing (test.030) was scheduled for Sunday, February 20, 1966, but was cancelled when the loss of the valve can vacuum occurred.

S-IVB-203, SACRAMENTO

The first attempt at static acceptance firing on S-IVB-203 was scrubbed at 8 p.m. PST February 18, 1966, when the LH₂ fill valve froze closed on the heat exchanger during chamber chill (T-580 seconds). Problems had been encountered early in the countdown when blowing helium leak in console "B" was thought to be the relief valve which was capped off. The primary flight batteries were used for this test, but were having problems with the battery heater thermostat. At the time the test was scrubbed, the GN₂ supply was low and with known H₂ leaks, this was considered very hazardous to continue.

NOTES 2-21-66 HOELZER

Negative report.

NOTES 2/21/66 JAMES

AS-207/208 DUAL LAUNCH: Dr. Shea has asked us informally about the feasibility of extending the S-IVB/IU continuous attitude control for this mission. We made a hasty evaluation and informed Dr. Shea that we thought we could maintain control for about 7 hours with only minor modifications with an approximate cost of about \$1 M (this is a very rough estimate). We would have to use Saturn V batteries for the added life. It appears that our primary problems would be freezing of the APS propellant feed lines and the ECS water supply line to the sublimator. We believe we can solve this by adding heaters or by intermittent operation. We may also have to carry additional GN₂ for the ST-124 air bearing system. Dr. Shea also asked about the feasibility of going over 8 hours. A quick look indicated that this is feasible but at a much greater cost.

AS-202 S-IVB BULKHEAD REVERSAL TEST: We have continued our investigation into the possibility of conducting this test on the AS-202. We have decided to list this test as a primary objective for this mission. It appears that we may be able to obtain sufficient ground coverage by using Antigua and by repositioning the Rose Knot Victor. I-MO is investigating the problem in repositioning the ship.

VLF 37B: The only items of GSE that have not been shipped to KSC are 4 battery chargers, 6 non-GETS panels, and 2 IU coolant units. All of these are expected to be shipped to KSC this week.

1. Support of MSC - Apollo Program: Recently, NAA/S&ID proposed a deviation from the MSC specification for testing crimped electrical connections. A preliminary investigation revealed that the MSC and the MSFC specifications were quite different. After consultation with R-QUAL and R-ASTR, R-ME set up a meeting at Houston attended by MSC, NAA, R-QUAL, and R-ME. As a result, a new specification has been agreed upon by both MSC and MSFC, and will be written into all present and future contracts. This is the first common specification and bears number MSC/MSFC-001.

2. Support of KSC: Equipment capacity at KSC for tube joining by brazing was inadequate to meet schedule requirements for space craft support at launch complexes 37 and 39. R-ME made available to KSC a complete induction brazing unit, a full complement of tube sizing and brazing tools, and further supported KSC with an engineer.

a. KSC was able to save \$150,000 on equipment which would only have been used for a short time.

b. Equipment for sizing tube ends developed by R-ME permits the use of tubing made to commercial dimensional tolerances. Until now it had been the general practice to use specially sized tubing bought as such. The new technique will bring about very large cost savings and by making it possible to use off-the-shelf tubing, it will ease scheduling problems.

c. Launch complex schedules will not be delayed because of tube joining problems.

NOTES 2/21/66 MAUS

1. BRIEFINGS TO MSF ON INCENTIVE CONTRACTING- A tentative schedule for the forthcoming meetings at MSF on Incentive Contracting has been established as follows:

- | | | |
|----------------------|---|---|
| March 21 (morning) | - | Briefing to Headquarters Key and Staff personnel on NOMATIC |
| March 21 (afternoon) | - | Workshop on NOMATIC |
| March 22 | - | Briefing to Dr. Mueller on NOMATIC |
| March 23 | - | MSF Forum on Incentive Contracting. This will include a 30-minute presentation by Mr. Gorman. |

2. APOLLO COST STUDY UPDATE - All contractors except NAA, S&ID (for S-II) have agreed to deliver necessary data by the first week in March. Because of the effort to incentivize the S-II contract it has been decided that S&ID will be asked to furnish data only after their incentive contract has been initiated. In order to meet the Headquarters deadline of March 25 we have decided to generate all S-II data in-house. We are working toward that completion date as requested by MSF but due to the limited time available it will be necessary to qualify this data. (It will not be possible to have center approval.) A March 25 completion date was established by Mr. Hilburn in order to use this data to derive follow-on vehicle costs for the AAP program in preparation of the FY 68 Preview Memorandum. This Preview Memorandum is due in BOB by May 1.

Standard Launch Vehicle: The Technical Systems Council has been working to add a future requirement specification to the standard launch vehicle definition, as you requested. We have developed a concept for a specification which would call out the standard launch vehicle as a baseline, with an optional "manned" kit and with a minimum number of optional mission-type kits such as extra batteries, four-gimbal platform, etc. We felt we could write such a specification to about the level of the SA-204 document, just finished, and have it rapidly available so that I. O. could define the vehicle to the contractors. We are using Frank Williams' AAP work, along with inputs from the council organizations. I feel such a document will be needed to put all of these studies and proposals in perspective. In view of present negotiations on the future IB vehicles and the other efforts going on, I believe we should synchronize our efforts and intent with all those involved, particularly Col. James and Dr. McCall, to give our document the proper impact. I plan to schedule such a meeting with you in the near future.

Special Topic: Saturn V Systems Development Facility (SDF)

● Schedule: Last week (2/14/66), I notified you that I plan to complete the activation of the Saturn V SDF on schedule. Despite RCA 110A and DDAS problems - late delivery of some GFP and a fire in the S-II ESE - we are within one day of planned schedule.

● Task Completion and Boeing Manpower Reduction: Cable installation and initial program planning on the SDF were essentially completed in the last ten days. As these tasks were finished, Boeing accordingly reduced their SDF manpower by 90 people.

● SDF Fire: At 0435 on February 17, 1966, a fire was detected and extinguished at the Saturn V SDF in two racks of S-II LUT ESE.

- Printed circuit boards were extensively damaged.
- ASTR, GE and Boeing agree that some redesign is required.
- Design problem isolated to S-II LUT ESE only.
- Similar racks in LC-39-1 have been recalled from KSC for necessary mods.
- Total schedule impact not assessed yet.

NOTES 2/21/66 SPEER

1. AS-201 REDLINE PARAMETERS: For several weeks, a major effort has been underway at MSFC to review and re-evaluate the redline values furnished to KSC for the AS-201 Launch Mission Rules. Many discrepancies have been pointed out, generally by KSC, among the various MSFC design documents, the Launch Mission Rules and contractor documents. KSC had also asked for as much relief as possible in the number of measurements that must be monitored down to the very end of the count. The final AS-201 values have been submitted to KSC on 2/18. A summary of the final sub-mission is as follows (previous numbers in parenthesis): Total line items: 67 (55); total measurements: 138 (127); of these measurements 54 (91) must be monitored until ignition at T-3"; 34 (36) are to be monitored until start of automatic sequence at T-2'43". All remaining redline measurements have been relaxed with regard to the time of the last mandatory check.
2. LVDC PROGRAMMING REQUIREMENTS: A meeting was held on 2/16 with R-ASTR to discuss flight control requirements that would influence LVDC programming. It was decided that the Flight Control Office (I-MO-F) would establish a standard Saturn IB requirement and specify additional non-standard requirements on a mission-by-mission basis. R-ASTR expressed concern that the flight control command tests planned for AS-203 might interfere with the LH₂ experiment and requested that consideration be given to performing these tests after the major events of the experiment have been completed. We are re-examining the mission time line.
3. MSFC AS-201 MISSION FAILURE CONTINGENCY PLAN: The MSFC plan was published on 2/18/66. The plan is designed to govern MSFC participation in any AS-201 failure investigation and to cover the alternates outlined in the MSF plan.
4. AS-201 FLIGHT CONTROL: Mr. Hayes (IBM), a contractor member of the MSFC Flight Control Office at MSC, arrived at Recife, Brazil on 2/16. He is now on duty on board the Atlantic Control Ship (Rose Knot Victor). The entire ship flight control team participated in integrated mission simulations on 2/16.
5. AS-201 COMMAND TRANSMISSION: Due to noise experienced on transmission lines from Houston to KSC new command procedures have been developed. The Flight Director will relay by voice all command requests to Central Control at the Cape. Command will be executed by Central Control.
6. AAP GROUND SUPPORT REQUIREMENTS: It appears fairly certain that the Gemini requirements group at OSRO will handle future AAP requirements. Centers will be asked for contributions to an AAP Program Support Requirements Document (PSRD) by 8/1/66. Guidelines are being established by the Center representatives at OSRO.

NOTES 2-21-66 Stuhlinger

1. PEGASUS: No significant changes. We continued to furnish M. Ames detailed information on the project for his testimony before Congress.
2. AAP: Lunar Surface - Dr. Jack Hanley, OMSF, visited us two days to discuss the drill and the lunar surveying staff programs. The availability of 1966 funds is still an unknown. We impressed upon him that the drill test and evaluation program is nearly ready to roll, and that it rates high on our priority list of lunar surface experiments to receive funding support. This program is unique in that we have extensive ties with other agencies (JPL, Bureau of Mines, Corps of Engineers.).
3. RESEARCH ACHIEVEMENTS REVIEW: The Research Achievements Review on February 24 will cover the areas of Advanced Propulsion Research, and Lunar and Meteoroid Physics Research. This review will be given by members of RPL, with one talk on Nuclear Propulsion to be given by Mr. Will Jordan of Advanced Systems Office. We will have displays to complement the talks.

NOTES 2/21/66 WILLIAMS

1. AAP Mission Assignments. We have received an updated version of the Mission Assignments Document from MSF dated January 20, 1966. Thus far I have received no request for comments, etc. At present I am making a limited distribution as well as an analysis and am attempting to determine who else may have received copies through other channels. After a quick review there do not appear to be any "mission" changes in this version and the basic updating was to include the names/numbers of some additional experiments for certain flights. Also, the follow-on AAP flights (through 228 and 525) have been included with more specifics than were given in the December edition.
 2. Grumman Aircraft Integration Study. Due to bad weather (the Grumman people couldn't get out of New York), the Grumman Integration Study presentation was cancelled on February 17 and has been rescheduled for March 8. Details to follow in a memo-announcement to people involved or interested.
 3. Workshop/Airlock Slice Proposal. Copies of the MSFC Proposal Definition Document on the Workshop/Airlock Slice have been forwarded to George Low and Ed Gray along with a letter of explanation; that is:
 - Low - We had the information ready; it can probably be used by MSC.
 - Gray - To complete our obligations to MSF, and clearly stated it was for historical purposes only.
- A limited distribution (6 copies) will be made available internally at MSFC.
4. MSFC/MSC Interface on Workshop. I am setting up a meeting with MSC on Friday, February 25, to start the ball rolling on the Workshop and experiments. MSFC people will be Horton, Reinartz, Ferguson, McCall and myself. I discussed this with McCall and he agrees.

FEBRUARY 28, 1966

direct 3/2/66

GEORGE C. MARSHALL SPACE FLIGHT CENTER
HUNTSVILLE, ALABAMA

Memorandum

van

TO : Dr. von Braun, DIR
Through: Mr. Weidner, R-DIR

FROM : Director, Astrionics Laboratory, R-ASTR-DIR

file

SUBJECT: Supplement to Weekly Notes of 2/28/66

B 3/3

DATE: March 1, 1966

A summary report on the 2/17/66 equipment fire in the Saturn V System Development Facility was not included in my 2/28/66 notes because of late receipt of the final report on the incident. The elapsed time (2/17 to 2/28) was needed to investigate the cause of the fire, extent of damage, corrective action needed, and possible program schedule delay.

EQUIPMENT FIRE IN SATURN V SYSTEM DEVELOPMENT FACILITY (SDF): At 4:35 A.M. on 2/17 a fire was reported in the S-II electrical support equipment. Several printed circuit boards were damaged to the extent that the damaged components were removed and returned to General Electric for checkout and design evaluation.

Primarily the failure was due to 5 out of 7 patch distributors being incorrectly patched and due to faulty design in the printed circuit board that allowed 1.7 watts to be dissipated across a 0.5 watt resistor.

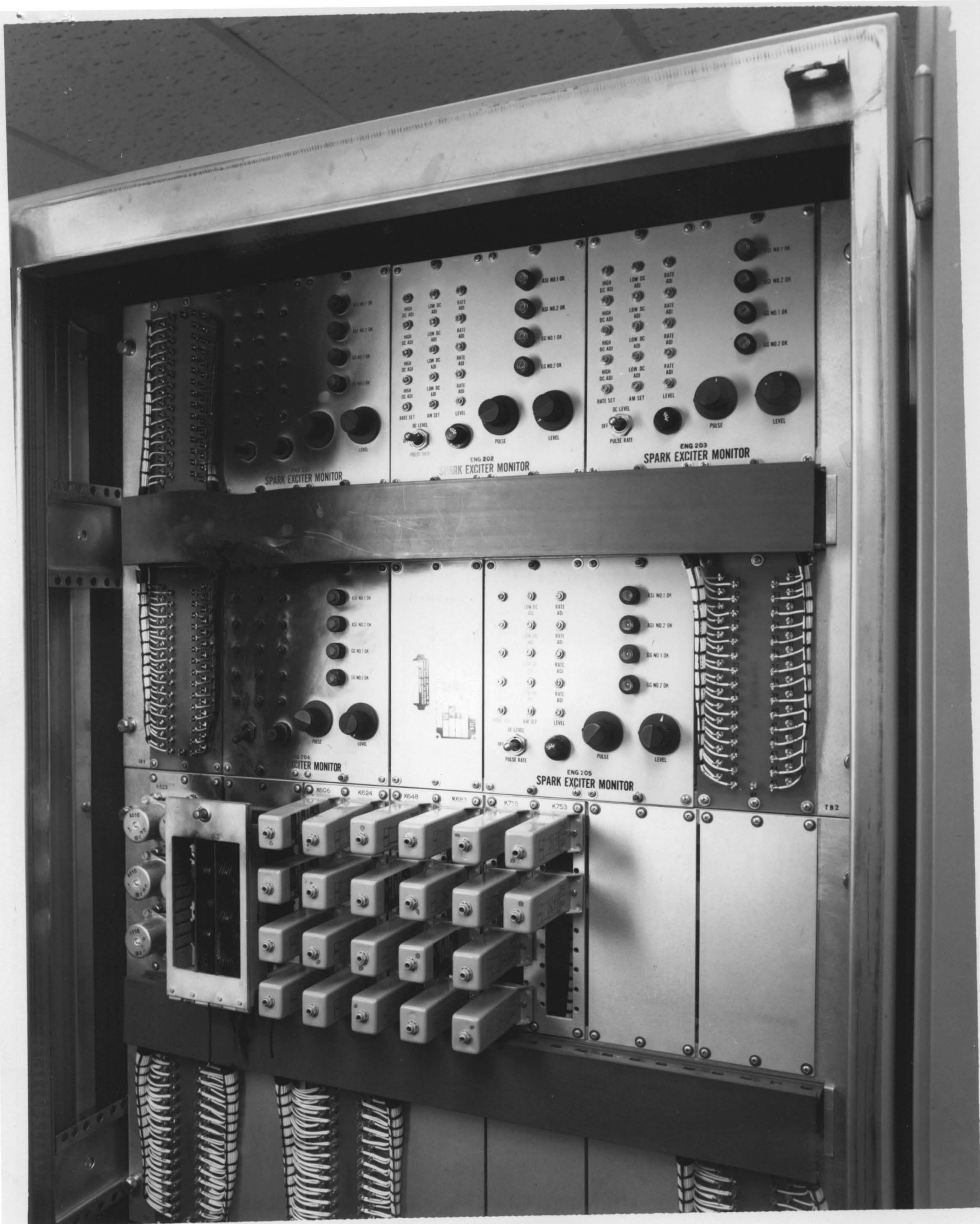
The printed circuit boards have now been redesigned, the patch distributors rewired, and the equipment is now back in operation. The S-II portion was inoperative for approximately 3 days. While this time lost was detrimental to the overall activation of the SDF, it cannot be said that the schedule was impacted by the fire because other portions of the SDF were farther behind schedule than the S-II portion.

W. Haeussermann

W. Haeussermann

2 Enc:
Photographs (Dr. von Braun only)





Enc 1

STILL CAPTION

20

SET NO.	CO NO.	NEGATIVE NUMBER	CLASS	MONTH	YR	SIZE	LEN/FR
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21-00

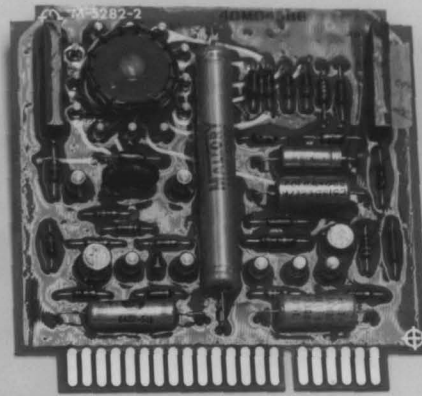
Fire in Saturn V Breadboard Facility, Bldg. 4708,
view No. 2.

DATE:

2-17-66

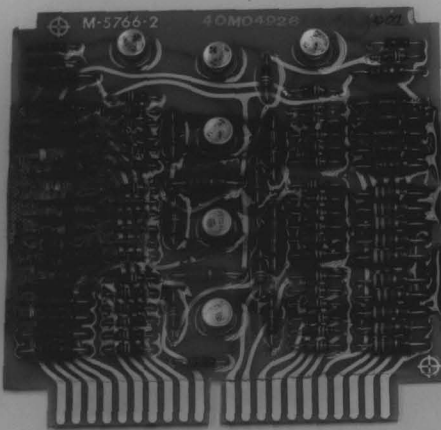
PHOTOGRAPHER:

Cooper

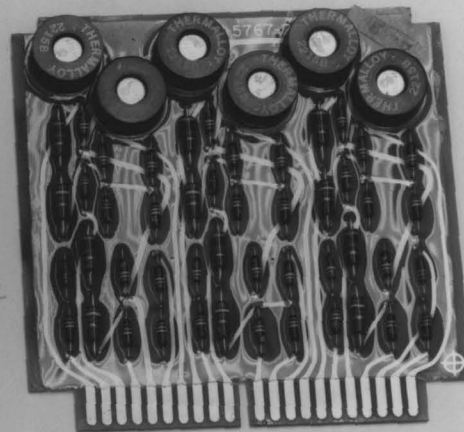


A3

202-234

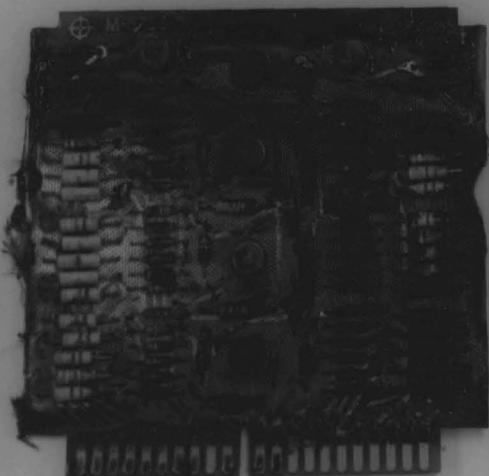


A1

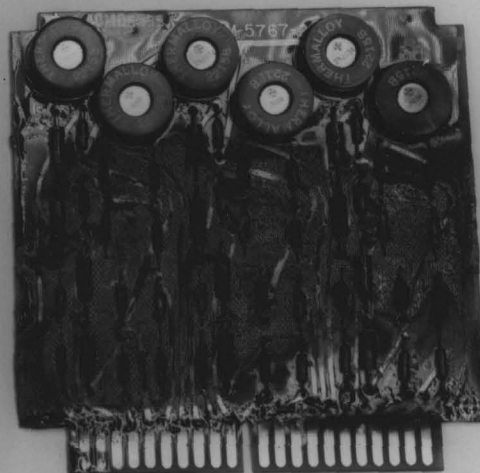


A2

202 224A2



202 223 A2



STILL CAPTION

20

SET NO.			CD NO.		POS		NEGATIVE NUMBER					CLASS		MONTH		YR		SIZE		POS		LAB/CFG	
					A	3	6	1	7	2	U			0	2	6	A			1	4		

DESCRIPTION:
21-80

Fire in Saturn V Breadboard Facility, Bldg. 4708,
view No. 1.

DATE:

2-17-66

PHOTOGRAPHER:

Cooper

NOTES 2/28/66 BALCH

S-II-T Stage - Leak detection functional checkout was completed on February 22, 1966. Retest of forward bulkhead insulation was delayed until February 24, 1966, because of the failure of pressure regulators used in the temporary test setup. The engineering run is now complete, and the sell run is nearing completion. Flow and leak test of insulation repairs to aft systems will be delayed several days because of decision to install the support brackets for the hydrogen recirculation lines prior to LN_2 tanking. GSE single point ground requirements have been modified by S&ID, Downey, to eliminate constraint on S-II-T firing. Fusing of circuits required prior to stage electrical control checkout is complete. Stage electric control checkout is now scheduled to start on February 26, 1966. A sequence adjustment to the original plan, to take effect upon completion of the stage electrical control checkout, is currently being evaluated.

S-II Test Stand A-1 - Decision has been made to use space in the warehouse addition at MTF for reinspection and repair of structural steel received with defective welds. This work is progressing on a two-shift basis. Took beneficial occupancy of instrumentation tunnel from test stand to TCC on February 18, 1966.

S-IC Test Complex - Topped off concrete on west pier of test stand at elevation 183.33'. This completes all concrete pours on test stand except that for Position B-1 flame deflector, which is now about 60% complete. Walk-through inspection for beneficial occupancy of ninth and tenth floors, center pier, is planned for next week. Interim turnover of RCA 110A computer to Boeing has been made pending completion of final turnover documentation.

Technical Systems, Phase I - Action was initiated to assure completion of the data handling system in the DHC in sufficient time to support the S-II-T firing.

Technical Systems, Phase II - Checkout of one-third octave analyzer system has been discontinued because of equipment malfunction. It is estimated that the checkout can be resumed in approximately three weeks. Wismer and Becker was selected for installation of S-II Test Stand A-1 cable trays, and this work began on February 21, 1966.

Local Airport Situation - NASA representatives from MTF and MSFC met with representatives of FAA and the Mississippi Aeronautics Commission on February 23, 1966. It was agreed that NASA would support a Hancock County Airport and would so indicate in appropriate communication to FAA and CAB.

Highway 43 Bypass opening delayed by weather until March 20. Present plans call for closing site to public thru traffic on March 21.

F-1 ENGINE

The first S-IC-4 engine was delivered by Guppy to Michoud on February 21.

RL10 ENGINE

The Navy and MSFC have both signed the delegation of administrative functions at West Palm Beach, Florida, to the Navy Bureau of Weapons.

Fourteen tests have been conducted on an R&D engine (FX 150) built to the production engine bill of materials. The average specific impulse from these tests is 444.

C-1 ENGINE

A technical orientation was held at MSFC February 24 and 25, in which RMD briefed MSFC personnel on the design and status of the C-1 engine. In summary: A prototype engine has been released; areas requiring concentrated development effort are well defined and effort is being directed toward these areas; analytical and experimental data to date indicate specification performance is attainable without major deviations from present planning.

J-2 ENGINE

The engine for S-IVB 207 was delivered to Douglas this week.

Two S-II Battleship tests were conducted this week. The first test was terminated after 60 seconds by a faulty gas generator over temperature (GGOT) measurement. The second test was for 361 seconds and was terminated by the LOX depletion probe system. Both tests included PU excursions, gimbal evaluations and active LOX and fuel recirculation systems.

An S-IVB 203 acceptance test was aborted after 140 seconds due to a fire from a leaking unused GG Bleed Valve instrumentation port. The leak was detected prior to the test, however, DAC did not have sufficient confidence in the detection techniques to stop the test.

AEDC-ARO has advised that the initial firing date (July 1966) is paced by deliveries of facility hardware (steel plate for the secondary diffuser, valves, and pipe fittings). We are investigating possible sources for the valves and piping, including MSFC Test Lab, MTF, Lewis Research Center (surplus property from the M-1 program at Aerojet), Rocketdyne (Canoga Park and EAFB) and Douglas-SACTO.

J-2 engine J-2019 was successfully fired for 300 seconds during the acceptance testing of S-IVB Stage of Vehicle 203 February 26.

Preliminary data indicate that the J-2 engine, J-2015, met all requirements during the flight of Vehicle 201.

H-1 ENGINE

R&D testing was completed on a modified LOX seal and Rocketdyne personnel presented the resulting data to MSFC on February 24. The recommendation will be to retrofit S-IB-5 and subsequent prior to static test and if no problems are encountered on S-IB-5, retrofit of S-IB-2 through S-IB-4 should be accomplished. The latter recommendation will be made after S-IB-5 has completed static test.

PRESENT STATUS OF S-IB STAGES AT MICHOU

- S-IB-3 - In post static checkout, tentatively scheduled to leave checkout on or about March 2, 1966
- S-IB-4 - Post static modification
- S-IB-5 - Enroute to Huntsville for static testing
- S-IB-6 - In final assembly, tentatively scheduled to go into pre-static checkout on March 3, 1966
- S-IB-7 - In final assembly (approximately 40% complete)
- S-IB-8 - Structural sub-assembly operations (approximately 90% complete)
- S-IB-9 - Structural sub-assembly operations (approximately 5 to 10% complete)

PRESENT STATUS OF S-IC STAGES AT MICHOU

- S-IC-503 - In Horizontal Installation position and is on schedule; all engines have been installed and installation of components is progressing satisfactorily.
- S-IC-504 - On schedule in the VAB; fuel tank painted and LOX tank closed out, intertank and forward skirt painted, with thrust structure in build up position, fins and fairings fit-checked.
- S-IC-505 - Both halves of the fuel tank, the bulkheads for LOX tank and all skin rings have been fabricated. The intertank is approximately 30% complete and the thrust structure is approximately 45% complete.
- S-IC-506 - Thrust structure build up has started.

We have no known problems with respect to on-schedule stage assembly and delivery of S-IB and S-IC stages.

NOTES 2-28-66 DANNENBERG

1. Configuration Management - Today a display on "Configuration Management" has been set up in the lobby of building 4200; this display demonstrates how Configuration Management relates to the Apollo program and outlines the capabilities of the system. It is planned to keep the display in the 4200 lobby for this week. It will be reoriented for the contractor meeting on "Interface Control Documentation" on March 8, to define in more detail the part that ICD's have in the system. After this meeting it will be rotated to other MSFC locations, and later on possibly also to selected contractor plants participating in the Saturn/Apollo program.
2. Interface Control Documentation - Major progress has been made in the ICD identification process insofar as the "baseline" for Saturn V ICD's has been "frozen" by R&DO. A listing of ICD's for SA-501 is being forwarded today to the Saturn V Manager for contractual implementation of defined ICD's at all Saturn V contractors. These ICD's will be implemented contractually by Level II (Program level) Change Board action. Any future changes from this "baseline" list will have to be channeled through this Level II Change Board, as well as any modifications, deletions, or additions to the contents of the documents.

Similar action is underway for the Saturn IB program; in fact, the definition of required ICD's for the Saturn IB program in its entirety is in a more advanced status.

NOTES 2/28/66 FELLOWS

1. FY-66 Initiations - Procurement actions to initiate Saturn Program funds are keeping pace with planned effort. In "SRT," we are in good shape in three of the four Headquarters Program areas - OMSF, OSSA, and OTDA, but still have about \$4.5 million to initiate for OART. A meeting was held last week with Mr. Cook and Mr. Miles to outline a detailed approach to the issuance of OART actions which would afford a more positive management of FY-66 initiations. It is expected that all programs will be initiated by the end of March as planned.

"SRT" NASA Program Office	Program Authority	2/18 Report of FMO Official Initiations	2/11 Report of FMO Official Obligations
OSSA	608,000	486,000	199,000
OTDA	1,500,000	1,334,000	207,000
OMSF	8,650,000	8,599,000	1,345,000
OART	16,014,000	11,608,000	2,165,000

2. FY-67 Procurement Planning - In cooperation with FMO and P&C, plans have been made for effective methods of authorizing and processing FY-67 initiations beginning in April this year, three months earlier than past years. Mr. Hardeman will issue FY-67 initiation authority about April 1, and Mr. Buckner will process our procurement requests short of obligation. This approach will allow the signing of contracts in July and give us a running start toward the accomplishment of our fiscal responsibilities in FY-67.

NOTES 2/28/66 GEISLER

1. Environmental Monitoring System: We are taking a first look at the desirability and feasibility of an operational Space Environmental Monitoring System (SEMOS), which has been proposed within Aero-Astrodynamics Laboratory, with first results due March 15. The basic concept involves incremental growth from AAP piggy-back packages, to automatic space-buoys, and then to a (prime mission) manned or semi-manned Environmental Monitoring Platform. First discussions by Messrs. Bill Vaughan, Bob Smith and J. von Puttkamer with key personnel from other agencies (such as ESSA, MSC, NCAR=National Center for Atmospheric Research) seem to indicate that we are on the right track. At the National Environmental Satellite Center (NESC) of ESSA (Environmental Science Services Administration) Joachim Kuettner is heading an ESSA-wide study of requirements and operation of Manned Environmental Space Platform, almost identical with the final system in our SEMOS concept. He is interested in our study, which is apparently complementing his work. An exchange of information through the official NASA-ESSA channel, the establishment of which has been suggested to Dr. Seamans by ESSA-chief Dr. White (and which could run through Morris Tepper's office at OSSA) appears very desirable.

2. Guidance and Space Flight Theory Contracts: The 24th Technical Meeting between MSFC and our contractors conducting guidance and space flight theory studies was held Feb. 16 & 17, 1966. Papers were presented in areas of stability theory, control theory, and guidance concepts. The following papers on stability theory were exceptionally good and presented significant results: (a) "Modern Version of Liapunov's Stability Theory" by Dr. LaSalle of Brown University; (b) "Some Stability Results for Linear Time-Varying Differential Equations" by Dr. Infante of Brown University; and (c) "Estimation of the Domain of Attraction" by Dr. Geiss of Grumman Aircraft. Based on attendees' comments, this meeting may have been the best in the entire series to date. During the introduction, Mr. Lovingood of our Astrodynamics and Guidance Theory Division, emphasized the importance of new work to be done in areas of orbital transfer and rendezvous problems, and encouraged the contractors to direct some of their future effort to these areas.

3. Fluorine Hazards and Diffusion Working Group: Mr. Scoggins and Mr. Kaufman of our Aerospace Environment Office attended subject working group meeting at NASA Headquarters, Feb. 16 & 17. Purpose of meeting was to review status of work and discuss future plans regarding use of FLOX in NASA vehicles. Our primary concern is with hazards associated with use of FLOX, and in particular, atmospheric diffusion. Our representatives presented a status report on recently developed mathematical diffusion models to representatives of OSSA and OART. Mr. Tischler, OART, is interested in solving diffusion and toxicity problems associated with the use of FLOX, but stated that funds are not available for full-scale experimental program. However, he will make available approximately \$200,000 for atmospheric diffusion work if a worthwhile program can be carried out with this amount. We are preparing scope of work within this limitation. Our future participation in the fluorine program should be defined soon after Headquarters receives our proposal. Results of this program may be applied to other programs which use any type of toxic fuel, e. g. dispersion of by-products from nuclear engines, nuclear detonations, etc., and other pollution studies. As a point of interest, the Huntsville air pollution control officer, Mr. William Dobbins, has contacted our Aerospace Environment Office, regarding dispersion of unpleasant air contaminants in the Huntsville area.

RCA 110-A COMMITTEE: As previously reported, the MSFC committee on the RCA 110-A parity problem has completed Phase I of the investigation (establishment of a solder repair procedure). Phase II (identify problem cause and effect a preventative solution) and Phase III (assess responsibility) findings are as follows:

RCA module boards would not accept solder in the flow soldering machine and dewetting was evident over the entire board area due to improper cleaning and protective coating of the copper circuitry and lead material before flow soldering.

Conformal coating on the boards had areas of tackiness and poor adhesion on the interface of the coating.

From 35% to 75% of all solder joints on module boards received from RCA had been reworked by hand. A rework ratio of considerably less than 5% is normally encountered.

PR-1538 polyurethane coating has sufficient shrinkage-expansion to cause cracks in POOR solder joints at normal operational temperatures i.e., approximately 65°F to 140°F (18°C to 60°C). Stress of polyurethane combined with stress of dissimilar metal (Kovar vs. tin-lead) can produce cracks in good solder joints at extreme temperature conditions.

Tests indicate that strain relief in transistor leads, tall spacers and a hole size tolerance of .005" diameter between the hole and lead size is an additional "safety factor" when extreme temperature conditions are encountered.

Recommended action, which is now pending RCA's reaction, is to proceed with the manufacture of the remaining spare module boards, under the existing approved specification. Dispatch MSFC personnel to RCA, Camden, to "clean up" the processing problems connected with machine soldering. Keep one quality resident MSFC representative at Camden until a satisfactory board assembly is being produced and a good inprocess inspection maintained to assure reliability. Assure that on future contracts design and manufacturing personnel carefully consider the "safety factors" such as hole size, stress relief, spacer size, etc. when soldering transistor leads.

NOTES 2/28/66 HAEUSSERMANN

No submission this week.

S-IC

The second S-IC-1 stage static firing was successfully conducted at 2:59 p.m. on February 25, 1966. The test was terminated at 80.2 seconds of mainstage by the redline observer when the second redundant thrust chamber pressure measurement failed on engine position No. 1. Cutoff of the engines occurred in the planned 3-2 sequence 100 milliseconds apart. All test objectives were attained. Present plans are to remove the stage from the test stand as soon as possible.

S-IVB (MSFC)

Test S-IVB-016 was conducted on Monday, February 21, 1966, for a duration of 40.6 seconds. The test was planned for a duration of 425 seconds plus; however, the GG over-temperature automatic cutoff device (GGOT) gave cutoff at 40.6 seconds. Based on data evaluation, the high temperature sensed by the GGOT device was erroneous. The main objectives of the test were to simulate the back pressure caused by the LH₂ vent system at Cape Kennedy and the engine chill conditioning systems that the Saturn vehicle 201 would experience during countdown and flight. The main objectives were met successfully even though the test was prematurely terminated. Evaluation of records indicated that vehicle 201 would operate satisfactorily under the conditions simulated.

S-IVB 203 (SACTO)

The second firing on 203 was accomplished on February 22, 1966, for a duration of 143 seconds. Cutoff was by observer when a fire was detected in the gas generator area. Minor damage was incurred. The third and final successful acceptance firing of the 203 flight vehicle was conducted on February 26, 1966, for a duration of 284 seconds. Cutoff was from the lox low level probe at 1.4% residual. Approximately 48% LH₂ remained at cutoff and the stage orbital coast period was simulated immediately following the firing.

S-II BATTLESHIP (SANTA SUSANA)

Two firings were conducted this week. Test No. 030 on February 22, 1966, was cutoff after 69 seconds by the automatic gas generator overtemp probe on Engine No. 2. This later was found to be shorted.

Test No. 031 on February 24, 1966, was for 360 seconds duration with cutoff by the lox low level probe. All objectives including LH₂ and lox recirculation, chamber chill using the A7-71, hot gimbal, and P.U. active, were accomplished.

S-V SERVICE ARMS

Three service (swing) arms; the S-IC inter tank, S-IC Fwd, and the S-II Fwd were loaded on the Barge Poseidon on February 27, 1966, for shipment to the Cape on March 1, 1966. The S-IC Fwd arm was fully tested and the S-IC inter arm partially tested. The hinges and propellant lines were assembled to the S-II Fwd arm, but no tests were run due to insufficient time.

S-V HOLDDOWN ARMS

The second set of fully tested arms were shipped to the Cape on February 25, 1966, for installation on Mobile Launcher No. 2.

NOTES 2-28-66 HOELZER

R-COMP-RR SUPPORT FOR MTF:

A cooperative effort is being conducted with Computation Laboratory, Data Reduction Branch (R-COMP-RR), and Michoud Assembly Facility, Computer Operations Office (I-MICH-OC), to provide backup for the DHC (Data Handling Center) at MTF during static testing of the SII Battleship. Present plans call for modifying the existing Computation Laboratory computer programs, which accept West Stand output format, to accept the output format of the DAF (Data Acquisition Facility) at MTF. This computer program modification will be accomplished by R-COMP-RR. The computer program will then be run by R-COMP-RR personnel on the computer equipment at Slidell with input data from MTF within twenty-four hours of the first SII Battleship firing. During these runs, Contractor personnel at Slidell will be trained in the use of the program to insure that future routine support from R-COMP-RR is not required. During this period, transceiver tests will be conducted to insure that R-COMP-RR can provide emergency support at MSFC, if required. Slidell already has in operation R-COMP-RR developed telemetry programs which will be required to reduce telemetered data from subsequent SII static firings.

NOTES 2/28/66 JAMES

AS-201 LAUNCH: The high pressure sphere in the S-IB Stage, which caused us so much concern prior to launch, appeared to perform quite satisfactorily during launch. The pressure was 2925 psi at liftoff and dropped to 1300 at cutoff, which was well above the minimum required. Preliminary information indicates S-IB cut off about .8 of a second late, with a 5 1/2 second interval between in-board and out-board cutoff. The S-IVB burn was approximately 10 seconds too long and the S-IVB cutoff velocity was estimated to be 10 to 15 meters per second higher than predicted. The early concern that there may have been some degradation in the S-IB Stage performance is not substantiated at this time. The TWX to Headquarters will be forwarded within 72 hours after launch and the final TWX to Headquarters within 10 days from launch.

S-IVB-203 STATIC FIRING: On February 22, 1966, an attempt was made to static fire S-IVB-203 and was aborted just prior to engine start due to a GSE problem. The count was recycled and a firing which proceeded, on the same date, to 142 seconds was cut off due to a fire in the area of the fuel pump. Inspection revealed a leaking seal at a high pressure instrumentation port on the G. G. bleed valve. On February 26, 1966, we completed planned duration run of 285 seconds. Performance looked satisfactory and data is being evaluated.

SATURN IB/APOLLO ASTRONAUT FAMILIARIZATION COURSE: We have been asked by Bob Sayers, Crew Safety Section at Houston, to conduct at MSFC an astronaut familiarization course for the Saturn IB vehicle. This course is currently planned for April 19 through 21, with 2 days of classroom type briefing and 1 day for tour and demonstrations. Slayton is to confirm this requirement with me in the near future. We are proceeding with plans with R&DO for this course. I would like to offer you the opportunity to make some opening remarks to the astronauts on the first day if your schedule permits.

SA-203 LAUNCH: Last week I discussed with Gen. Phillips, Dr. Shea, and Col. Petrone the Saturn IB Apollo Program planning at KSC. Some of this planning I have conveyed to you during our discussions at KSC. The most eminent change is the launch of 203 ahead of 202. We have expected this and have been proceeding with action to accomplish this change. We have also confirmed the 207-208 dual launch.

1. Welding Technology Development for Aluminum Alloy 2014: The fact that a number of structures for Saturn IB and Saturn V have been manufactured and successfully tested does not mean that all welding problems for these stages are fully understood and solved. This is indicated by a number of weld defects requiring repairs and even failures in load tests, as for instance the failure of a common bulkhead weld on S-IVB-503 which occurred last week. We have been aware of this situation and have been engaged for many months in a thorough in-house study and welding program for 2014 alloy. The program has now been completed and the report is being forwarded to DAC and S&ID. Some of the important conclusions we have reached are: (a) The size and complexity of the microconstituents in the heat affected zone in a multi-pass plate weld vary directly with an increase of the total welding energy input. (b) Increased time at high temperature increases the width of the heat affected zone in which grain structure changes occur. (c) The natural-aging strength response of 2014 plate weldments is functionally related to the microstructure as a result of total energy input into the adjacent heat affected zone. (d) One has to be extremely careful with major weld repairs, including selection of weld wire for such repairs, because the different passes of a major repair will be of different compositions. The combination of excessive weld energy exposure plus "mixed" chemistries results in a weld joint that will not meet design requirements. These viewpoints have been coordinated with P&VE Materials Division. We are now in a position to effect improvements and to optimize welding techniques for 2014 at our prime contractors. The lack of thorough and systematic studies at our contractors for plate welding is partly due to the fact that it was not recognized that data and experience from thinner gage welding (up to 1/4") cannot be directly applied to the welding of heavier gages.

2. S-II Adapter Ring for S-IC Test Stand: Drawings for this adapter ring have been handcarried to Michoud this weekend. The material -- approximately 80,000 lbs of stainless steel 304 -- has been procured by The Boeing Company and will be in Michoud today. 8,000 man-hours for manufacture of the adapter and approximately 1,000 man-hours for tooling have been estimated by us. Transportation will be accomplished by use of the pallet which was fabricated to transport the Thrust Structure from Michoud to Huntsville.

NOTES 2-28-66 LUCAS

1. QUALIFICATION OF S-IC ENGINE GIMBAL SYSTEM FLIGHT SUPPLY LINE

COMPLETED: The Flight Supply Line completed all qualification test requirements successfully. Development test lines burst lower than 7700 PSI. However, the two qualification samples exceeded the 8800 PSI level. One line burst at 9850 PSI. This line has been installed on S-IC-501 and has endured static testing.

2. GROUND WIND LOADS PROTECTION FOR SA-500-F: A truss damper will be provided to tie the tower and the vehicle together so that the vehicle will withstand the steady-state wind loads as well as the effects of vortex shedding. Mr. Sterett (R-P&VE-S) is responsible for the design, supported by Manufacturing Engineering Laboratory (Mr. Caruso). A detailed program was worked out between R&DO elements and Mr. Bramlet, Deputy Manager, Operations, Saturn V Program Office.

NOTES 2/28/66 MAUS

MSF POP 66-1 - The funding plans to be used in MSF POP 66-1 have been received. Planned funding for MSFC is less than our Apollo requirements in FY-66, 67, and 68. Reductions shown in FY-66 and 67 coincide with those which you already know. Attached chart 1 compares our requirements and the MSF position for each year.

The MSF plan transfers the C-1 Engine into AAP Supporting Development and eliminates Engine Development as a separate project beyond FY-67. The total resources for engines (except C-1) are included in Saturn IB and Saturn V. (My note of 2/24/66 provided the latest status of our efforts to have a separate Engines project reinstated.) MSF guidelines cut \$20.7 M (see attached chart 2) from FY-68 MSFC requirements for engine development but appear to provide some flexibility by increasing Saturn IB and Saturn V funding in FY-68 by \$13.8 M. Our net Apollo reduction in FY-68 is then \$6.9 M. The funds cut from our requirements in FY-66 and 67 were not reinstated in the FY-68 MSF plan.

The only funding included for MSFC in-flight experiments is that amount previously provided in Saturn IB (\$2.0 M in FY-66 and \$.9 M in FY-67). There are no funds set aside by MSF for experiments that will be approved in the future for either feasibility studies or development. As additional experiments are approved, they must compete for funds, in the Apollo office, with other elements for which the funds are now earmarked. Overall Apollo funding problems and this approach by MSF forewarn that funding for future in-flight experiments will be limited and difficult to obtain.

The guiding philosophy which was applied in MSF in arriving at the FY-68 plan was to hold down Apollo funding to give some opportunity to get AAP started.

POP COMPARISON (MSFC POP 66-1 AND MSF 66-1)
(Dollars in Millions)

	<u>MSFC</u> <u>POP 66-1</u>	<u>△</u>	<u>MSF</u> <u>POP 66-1</u>	<u>MSFC</u> <u>POP 66-1</u>	<u>△</u>	<u>MSF</u> <u>POP 66-1</u>	<u>MSFC</u> <u>POP 66-1</u>	<u>△</u>	<u>MSF</u> <u>POP 66-1</u>
Saturn I	0.5	0	0.5	0	0	0	0	0	0
Saturn IB	250.1	- 1.6	248.5	215.5	-25.5	190.1	125.2	+ 8.8	134.0**
Saturn V	1,144.7	-16.8	1,127.9	1,159.7	-59.7	1,100.0	1,021.0	+74.5	1,095.5**
Engine Dev	<u>146.5</u>	<u>-13.3</u>	<u>133.2*</u>	<u>129.9</u>	<u>-22.9</u>	<u>107.0*</u>	<u>95.7</u>	<u>-95.7</u>	<u>0</u>
Apollo Total	1,541.8	-31.7	1,510.1	1,505.1	-108.1	1,397.0	1,241.9	-12.4	1,229.5
Apollo Sup. Dev.	9.5	0	9.5	12.0	- 2.0	10.0	8.0	- .7	7.3
AAP Sup. Dev.	0	+ 8.8	8.8*	2.0	+ 7.0	9.0*	6.0	+ 2.0	8.0**
Adv Manned Missions Sup Dev.	0	0	0	6.0	- 6.0	0	6.0	+13.0	19.0
Adv Studies	<u>5.5</u>	<u>- 1.0</u>	<u>4.5</u>	<u>9.3</u>	<u>- 4.8</u>	<u>4.5</u>	<u>12.1</u>	<u>- 2.1</u>	<u>10.0</u>
MSF Total	1,556.8	-23.9	1,532.9	1,534.4	-113.9	1,420.5	1,274.0	- .2	1,273.8

NOTE: No provision has been made in MSF POP 66-1 for total In-Flight Experiments Requirements (Included are \$2M for FY-66 and \$.9M for FY-67 which is shown in Saturn IB project)

* C-1 Engine funding has been deleted from the Engine Development Project and included in the AAP Supporting Development Project as follows:
\$8.8M in FY-66; \$9.0M in FY-67 and \$5.5M in FY 68

** See Chart 2 for explanation of Engine Development Realignment.

ENGINE DEVELOPMENT FY-68
(\$ IN MILLIONS)

	<u>MSFC</u> <u>POP 66-1</u>		<u>MSF</u> <u>POP 66-1</u>
H-1 Engine	4.7		Included Under Sat IB at \$4.0 M
J-2	23.5	} 69.0	Included Under Sat V at \$65.5 M
F-1 Engine	31.5		
Propellants	14.0		
C-1 Engine	5.5		Included Under AAP Sup. Dev. at \$5.5 M
Support	2.6	} 16.5	Not Included
APA	13.9		
Engine Development	<u>95.7</u>	Δ -\$20.7	<u>\$75.0</u>

NOTES 2/28/66 RICHARD

AS-201: It appears that all of the systems and techniques that we planned for Saturn IB and Saturn V worked. Besides the obvious gains, here are some additional thoughts.

a. Our use of modular redundancy throughout the vehicle appears to have been functionally correct, although we can't get actual flight tests of component switching unless we have failures.

b. The use of the vehicle digital computer to judge vehicle and subsystem performance and to take alternate steps, where necessary, was proven, not so much during flight, but in the Cape prelaunch tests.

c. Our ability to reconfigure the vehicle subsystem event timing and to change and verify the onboard program in general, without removing the computer, got an unexpected workout with excellent results.

d. Our approach, in the ground system, which allows complete intermix of automatic and manned control and monitoring of the vehicle system proved out well, and the recycling operations showed that it really works. This has been a difficult problem in most automated systems.

We have some cleanup to do, but we have passed a tremendous overall system milestone. We will improve the system response (including crew reaction) to ground software or hardware failures--an improvement I hope we don't use very often. We will also re-examine our "red-line" and interlock philosophy, in light of our experience. MSF has asked for this study and I feel we need it too.

1. S-IC-1 Stage Captive Test - The S-IC-1 was captive fired at 3:00 pm, Friday, February 25, 1966 for 83.2 seconds mainstage duration. Planned duration was approximately 125 seconds. Indications are that a double failure of Engine #1 chamber pressure transducers occurred, causing the redline observer to terminate the test at 83.2 seconds. No more captive firings of S-IC-1 are planned unless post firing data shows serious irregularity.

2. S-II Battleship Stage Firings:

- Tuesday, February 22, 1966 at 8:30 pm, CST a scheduled 200-350 seconds S-II Battleship Stage firing was terminated at 69 seconds with automatic premature cut-off due to gas generator over-heating. LH₂ and LOX recirculation system performed satisfactory.

- Thursday, February 24, 1966 at 5:00 pm, CST the S-II Battleship Stage successfully fired for a duration of 360 seconds (planned duration of 350 to 370 seconds). Cut-off planned for LOX depletion and was successfully accomplished. LOX and hydrogen recirculation, PU and engine gimbal systems performed satisfactorily. All test objectives were met.

3. S-IVB 503 LOX Tank Failure:

A weld failure in the hydrostatic test of the LOX tank on Thursday, February 24, 1966. An eight inch crack occurred at the Aft dome-common bulkhead juncture at 50 psig, 4.7 psig below the test pressure required to meet the 1.05 margin over working pressure. Preliminary assessment results by DAC and MSFC indicate the problem to be in a region of excessive weld repair. Records are being analyzed to see if other stages may have a similar repair sequence.

DAC intends to accelerate the 504 tankage to replace the 503 tank. The 503 tanks may be salvaged, but no decision will be reached as to disposition until the salvage method is established and a full analysis of the failure is completed.

4. Vehicle GSE:

LC-39-1 ESE - All LC-39-1 ESE, with the exception of one cable, is being FACI'd today (Monday, February 28, 1966). The cable will be delivered by Sunday, March 6, 1966, and KSC has verified that there is no program impact.

SDF Subsystems GETS - The subsystems GETS will be completed on schedule (Tuesday, March 1, 1966) at the Saturn V Systems Development Facility. Completion of this milestone is a major accomplishment toward delivery of our operating and test program tapes to KSC.

In summary, the LC-39-1 ESE delivery and the SDF subsystems GETS schedule was accomplished because of the will and determination of the people involved to want to do it, even though many, many people did not believe it possible to make these schedules.

NOTES 2/28/66 SPEER

1. AS-201 MISSION SUMMARY: Early indications from MSFC and MSC flight data show a very successful mission performance. The S-IVB cutoff velocity may have been 3-5 m/s higher, and cutoff occurred 10 sec after nominal. The marginal wind situation had improved by launch time; the space vehicle was 25% below its structural load capability. The S-IB Control Pressure Spheres were within required limits at cutoff (higher than 1000 psi). The tilt maneuver after S-IVB cutoff was successful. The Service Module Propulsion System experienced up to 10% variations in thrust. However, both burns were accomplished. Recovery sequence was as expected. The CM was spotted in upright position about 5 min after landing. Landing point was approximately 40 nm short, probably due to combination of cutoff vector and CM lift deviation. No commands had to be sent from the Mission Control Center for any reason.

2. AS-201 COUNTDOWN: Launch was scrubbed and rescheduled three times after reaching T-13 hours on 2/22 because of low ceiling clouds. Terminal count was resumed on 2/25. Launch occurred at 11:12 hours EST on 2/26. A 30 min hold happened at T-4:26 to complete propellant loading. A 29 min hold occurred at T-1:30. The 1 hour built-in hold at T-30 was extended to 78 minutes. The interlocked low S-IB control pressure indication caused cutoff of the first launch attempt at 9:03 EST. After an additional hold of 2 hours 9 min AS-201 was successfully launched.

3. AS-201 LIEF OPERATION: There were a total of 16 conference calls during the AS-201 countdown covering the following subjects: (1) S-IB control pressure spheres and calorimeter purge; (2) wind simulations; (3) engine #3 main LOX bearing temperature; (4) vibration measurements on IU/S-IVB mounting ring and IU computer panel; (5) mission rules; (6) guidance measurements; (7) S-IVB chutdown sequence; and (8) ground computer. In addition the results of six wind simulations were transmitted. Inflight data displays were quite satisfactory. Approximately 125 persons attended.

NOTES 2-28-66 Stuhlinger

1. PEGASUS: No significant changes.
2. AAP: Kollsman representatives gave a very satisfactory final presentation on their study contract concerning a LEM-mounted telescope (38") to be used on the lunar surface. Maximum use was made in this study of the Goddard-sponsored OAO telescope project. Dr. Nancy Roman commented favorably on the study and its results (she had been somewhat critical at the beginning of our work). Dr. Roman invited me to become a member of her Astronomy Subcommittee of the Space Science Steering Committee; I gladly accepted, and I believe that this direct relationship will be very helpful if and when the Astronomical Telescope Mount (ATM) Project is assigned to MSFC. I had several further discussions with Jesse Mitchell and his associates regarding this project. It is my feeling that MSFC has a good chance of being chosen as ATM project manager.
3. RESEARCH ACHIEVEMENTS REVIEW: The eleventh Research Achievements Review (RAR) was held last Thursday on advanced propulsion, lunar surface physics, and meteoroid physics. Speakers were from ASO and RPL. About 160 persons attended; Dr. Hoelzer and Dr. Geissler (both part time) were the only members of MSFC management.

This review concluded the first yearly cycle of the RAR.

NOTES 2/28/66 WILLIAMS

1. S-IVB Workshop Experiments. Bill Horton, Bill Ferguson and other MSFC personnel involved will be in Houston on Monday, 2/28/66, to meet with Mr. Kleinknecht and the MSC experiments people to make a first cut at a list and description of experiments for flight 209.
2. Workshop. We received a TWX dated 2/25/66 from Raffensperger, MSF, outlining certain requests and thinking with regards to the Workshop responsibility. (a) We are requested to prepare a "short version" of a Preliminary PDP for the Workshop experiments by 3/10/66. This can be done, provided MSC will cooperate. I will keep you posted. (b) The following extract from the TWX is of particular interest: "MSFC has overall system design and integration responsibility for the S-IVB Workshop."
3. Local Scientific Survey Module (LSSM). The LSSM technical panel meeting was held on February 25, 1966, at MSFC to review inputs from Bendix and Boeing on the special exercise (minimum cost lunar jeep) which was recently conducted. When the voluminous material has been digested, a preliminary MSFC briefing will be held. This will occur after the mid-term LSSM presentations presently scheduled for the week of March 7, 1966.